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COMETIC ORBITS,

WITH

COPIOUS NOTES AND ADDENDA.

COMPILED AND EDITED

BY

EDWARD J. COOPER.

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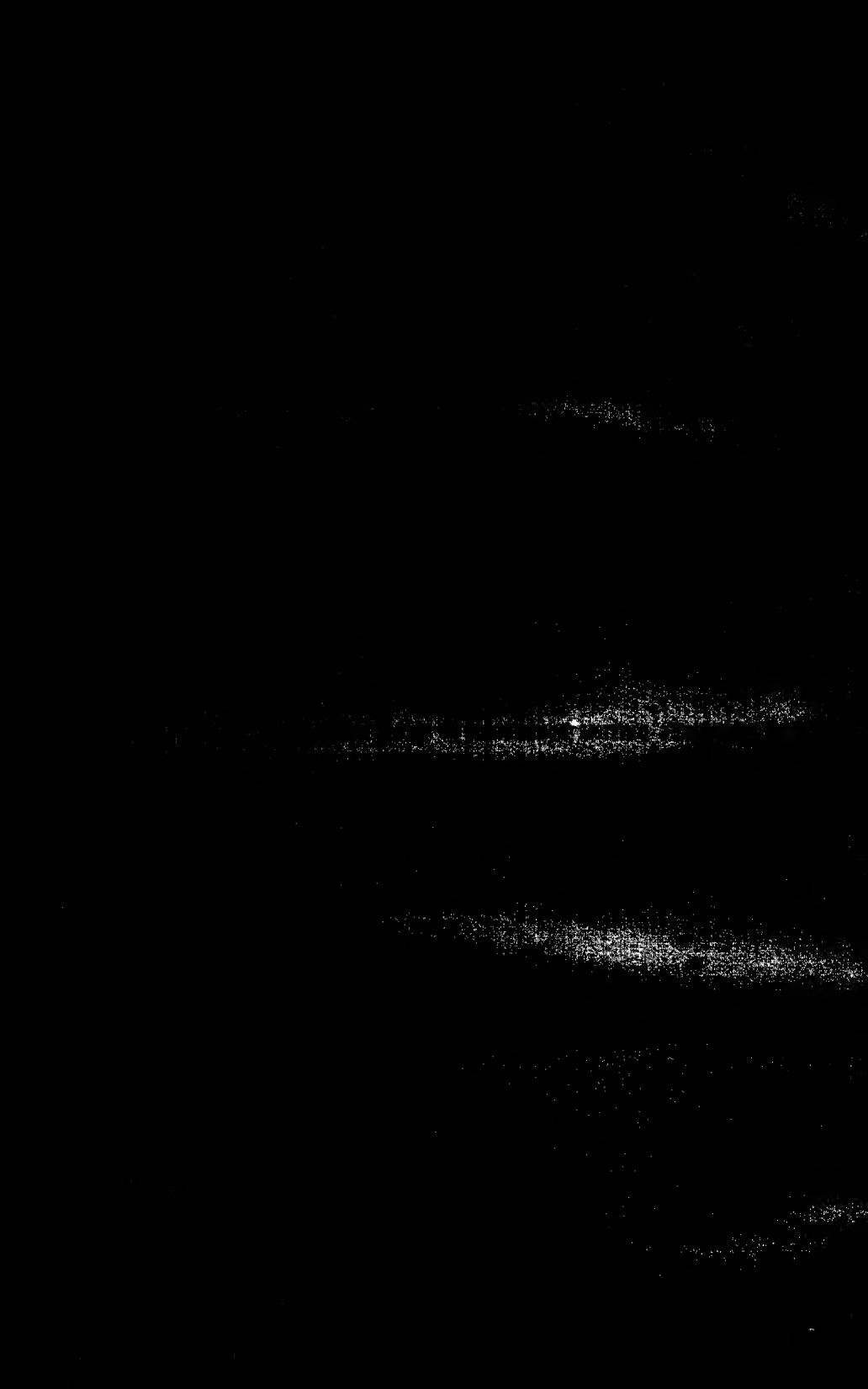
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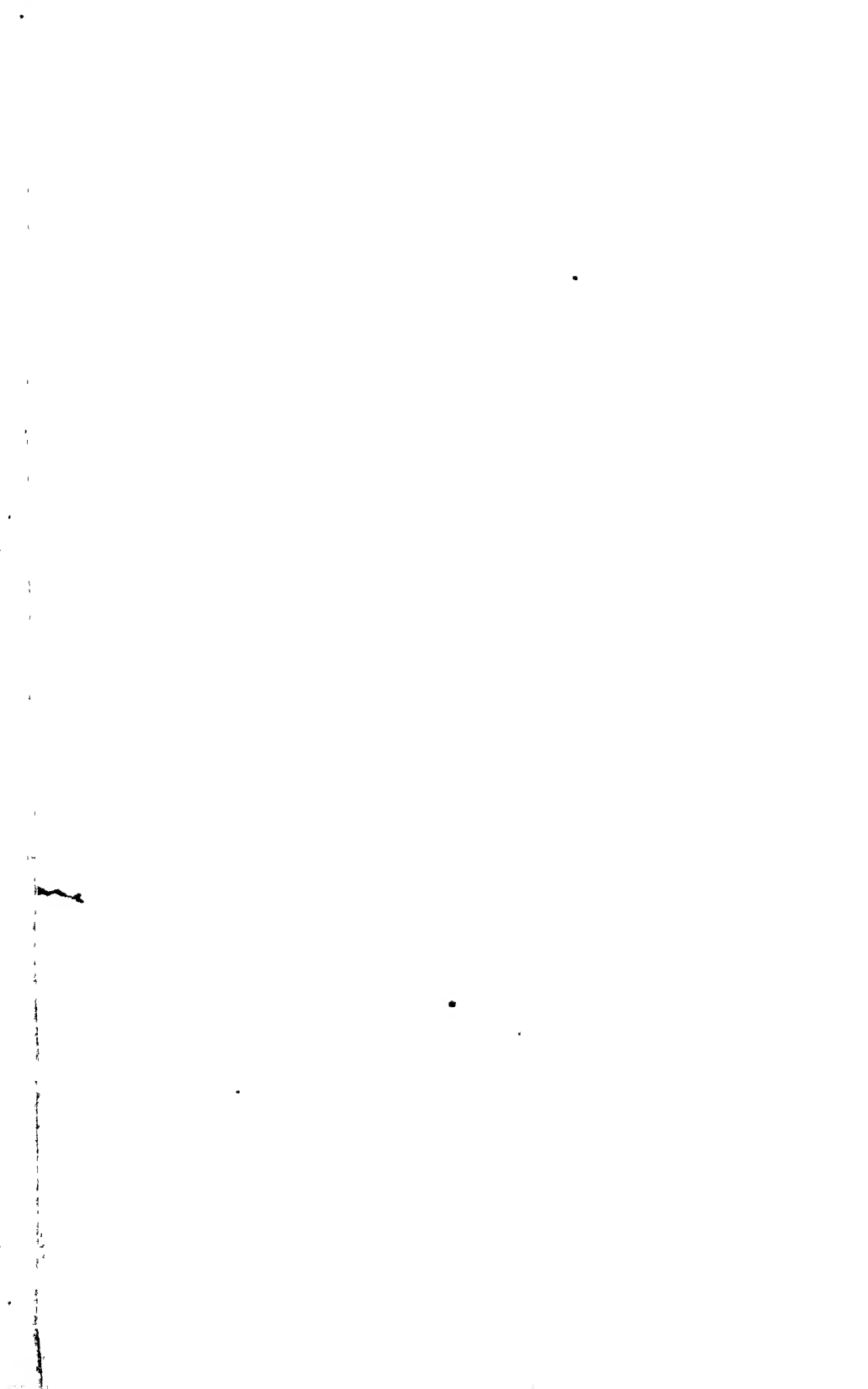
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THIS ATTEMPT
TO FACILITATE THE RESEARCHES OF ASTRONOMERS AND AMATEURS
INTO THE
HISTORY OF COMETS
WHOSE ORBITS HAVE BEEN COMPUTED,
IS INSCRIBED TO THE MEMORY
OF THE
MOST SUCCESSFUL BRITISH DISCOVERER OF THESE PHENOMENA,
MISS CAROLINE HERSCHEL,
AS A TRIBUTE TO HER MANY VIRTUES, HER REMARKABLE TALENTS,
AND PERSEVERING INDUSTRY,
BY
THE COMPILER OF THE WORK.

ABBREVIATIONS.

D. u.	. . .	Discoverer unknown.
Obs.	. . .	Observe, Observed, &c.
P. P.	. . .	Perihelion Passage.
L. P.	. . .	Longitude of Perihelion.
L. N.	. . .	Longitude of Ascending Node.
I.	. . .	Inclination.
P. D.	. . .	Perihelion Distance.
L.	. . .	Longitude.
l.	. . .	Latitude
D.	. . .	Delambre.
P.	. . .	Pingré.
A. N.	. . .	Astronomische Nachrichten
C. T.	. . .	Counaissance des Temps.
C. R.	. . .	Comptes rendus.
Z. C.	. . .	de Zach's Correspondence.
H. A.	. . .	Histoire de l' Academie, Paris.
Ph. T. or P. T.	. . .	Philosophical Transactions.
A. J.	. . .	Astronomische Jahrbucher or Berliner Jahrbucher.
M. A.	. . .	Memoires de l' Academie, Paris.
S.	. . .	Santini.
M. C.	. . .	Monatliche Correspondenz, by v. Zach.
Olb. Abh. (E).	. . .	Olbers' Abhandlung — Encke's edition, 1847.
L. ih.	. . .	Lalande's Astronomy, vol. 3.
G. E.	. . .	Geographische Ephemeriden, by v. Zach

P R E F A C E.

I WAS on the point of transcribing the following introduction to this work for the printer, when I accidentally opened the Appendix to Sir J. W. F. Herschel's "Outlines of Astronomy," in which I found written, "The reader will find a complete list of elements of all known comets up to June, 1847, by *all* their several computers, in Professor Encke's edition of Olbers' *Abhandlung*, 'über die leichteste und bequemste methode die Bahn eines cometen zu berechnen.' The list is compiled by Dr. Galle. It contains orbits of 178 distinct comets."

The somewhat distressing reflection, of course, immediately succeeded the perusal, on the 23rd of last January, of this passage, which I had not before seen or heard of—"Has my labour, then, been all in vain, and shall I hazard a publication that may be considered to be superfluous?"

The temptation, however, against an abandonment of the fruits of toil is great, and I have reconciled myself to the pursuit of my original intention in consequence of the fact, since ascertained, that very few notes, excepting such as refer to the orbits given, and occasionally to the Discoverers or Observers, are connected with the list mentioned by Sir J. W. F. Herschel; and that, consequently, the greater portion of my labour may be still productive of advantage to the public.

It will be perceived that I have availed myself of the opportunity of introducing into the Catalogue a few orbits taken from this excellent work of M. Encke. With the most praiseworthy fidelity, he scrutinized every orbit before its adoption. The errors which escaped detection are consequently as rare as is, perhaps, practicable. Mr. Graham and I have noticed a very few, and those are all we could discover. Where we had not the means of consulting the reference, we have invariably followed his Catalogue, wherein it differs from others. In such cases it is quoted as the authority. I have also compared the present Catalogue with

M. Schumacher's edition of Olbers' List of Comets, with the American Almanack of 1847, and also with M. Jahn's, published in the same year, and for an acquaintance with which I am indebted to the kindness of the Rev J. Challis. I compared also these Catalogues with the authorities quoted in them, so far as those authorities were to be found in the libraries of the Royal and Royal Astronomical Societies and I desire here to render my best thanks for the facilities so kindly afforded me at these eminent institutions.

I should also be most ungrateful if I did not here acknowledge the obliging readiness with which my distinguished friend, Sir J. W. Herschel, met my request to peruse the MSS, and the advantage it has derived from his suggestions. Lastly, it is necessary to state that, for most of the frequent discrepancies between the present Catalogue and those of others, Mr. Graham, and for the rest I, submit to the judgment of those gentlemen who are of acknowledged celebrity in the scientific world, and that we have, both of us, endeavoured to the utmost of our power to render the Catalogue correct. We do not pretend to perfection—where is it?—but we say—

“Si quid novisti rectius istis,
Candidus imperta si non, his utere mecum ”

EDWARD J. COOPER.

INTRODUCTION.

SEVERAL considerations moved me to undertake the compilation now offered to the public.

More than ten years since, when on the continent, I heard frequent complaints made of the want of some succinct Manual of Comets, and one or two foreign astronomers pressed me to undertake to supply it.

It is well known that when a first approximation to the orbit of a comet has been attained, the astronomer immediately seeks for an identification with some former apparition in the best catalogue he possesses. Oftentimes he, or an amateur at least, has but one, and this wholly insufficient for his purpose, inasmuch as many orbits of ancient comets have been computed very recently, and no catalogue, that I am aware of, extends to a late period. Again, in consequence of typographical errors, some of the existing catalogues are defective, and when it is added to this, that both the amateur and professed astronomer desire some knowledge of the physical peculiarities of a previous comet, and that to attain this they may be obliged to search through an extensive series of volumes, written in different languages, sufficient has been advanced to justify an attempt at even an imperfect consolidation of the principal phenomena for which search is necessary. But to meet the probable desire for more extended information than is given in this work, ample notes of reference are annexed to facilitate the inquirer, which would alone, it is hoped, save him much time and trouble. These references will also enable him to ascertain with ease the data from whence the elements in the catalogue were derived, and, frequently, the result of a comparison between the observed and computed places.

I need scarcely remark, that no pretension is made to credit for any thing beyond considerable labour in the formation of this work. The number of volumes, many of upwards of 1,000 pages, which have been examined, exceed 350. Besides, the transcript in the first instance of all the orbits to be found, and the arrangement for the notes, have occupied a period of time that the size of the volume would certainly

not indicate. However, the very fact of the great number of necessary references may, I trust, lead to indulgence towards those errors, which, with every care that has been taken, must be expected to occur

CATALOGUE.

In the selection of orbits of any comet, where a great number have been computed, I had the advantage of Mr. Graham's assistance. Our adopted rules were to prefer those calculated upon the largest arc, having regard to the soundness of the data, and the reputation of the computer to reject parabolic or hyperbolic elements where no doubt or but little existed as to the ellipticity of the orbit; and to preserve those elements of any one comet that agreed best with one another. The orbits are given with reference to Greenwich mean time, by whomsoever computed—not merely for the sake of uniformity, but as facilitating their conversion to the time of any given observatory. They are also given in the sequence of their perihelion passages, not in the order of their discovery. We adopted Delambre as the *nucleus* of the catalogue, but, so far as we found it to be practicable, every orbit was traced back to some standard work in which it was originally published, and where it probably came under the computer's inspection. In this way we were enabled to correct numerous mistakes. Incomplete orbits were rejected, as it was thought unnecessary to increase their number without adding to the utility of the work. Of course there was constant reference to Pingré. The care bestowed upon his entire work: the amount of time and labour necessarily expended on its compilation, and which can hardly be appreciated but by those who have ventured to tread in his footsteps: these, were there no other monuments of his astronomical labours, would entitle him to a place in the first rank, not merely among cometographers, but in the astronomical world. Lalande and Santini were consulted with advantage. Their design was manifestly to give only the very best orbit. Our plan, though select, was not so exclusive.

GENERAL REMARKS.

Sir John Herschel, in his admirable "Outlines of Astronomy," observes, "Apart even from the singularity and mystery which appertains to their (the comets') physical constitution, they have become, through the medium of exact calculation, unexpected instruments of inquiry into points connected with the planetary system itself, of no small importance."—p. 374. And again, "Yet we think it worth noticing that among the comets which are as yet known to describe elliptic orbits, not one whose inclination is under 17° is retrograde; and that out of thirty-six comets which have had elliptic orbits assigned to them, whe-

ther of great or small eccentricities, and without any limit of inclination, only five are retrograde, and of these only two, viz., Halley's and the great comet of 1843, can be regarded as satisfactorily made out. Finally, of the 125 comets whose elements are given in the collection of Schumacher and Olbers, up to 1823, the number of retrograde comets under 10° of inclination is only 2 out of 9, and under 20° , 7 out of 23. A plane of motion, therefore, nearly coincident with the ecliptic, and a periodical return, are circumstances eminently favourable to direct revolution in the cometary, as they are decisive among the planetary orbits."—p. 377. In his Appendix the following passage occurs immediately after the one extracted for the Preface to this work: "From an examination of these (the comets') orbits we collect the following as a more correct statement of cometary statistics than that in art 601 (p. 377), viz: Retrograde comets 10° inclination, 3 out of 15, under 20° , 9 out of 29. Retrograde comets moving in orbits sensibly elliptic, under 17° inclination, 0 out of 9. In such orbits from 0° to 90° , 11 out of 37. Thus we see that the induction of that article is materially strengthened by the enlarged field of comparison."—p. 652.

In consequence of these remarks relative to the small inclinations of the orbits of periodic comets, and which, Mr. Graham knows, had been made by myself some years ago, and the consequent resemblance, so far as the inclination is concerned, to the planetary orbits, I thought it desirable to investigate whether or not any other apparent analogy might be deducible from the heliocentric longitudes of perihelions and ascending nodes. For this purpose I constructed the following Tables.

TABLE I.—Elliptic Orbits in the order of their Inclinations

Comets	Inclination	L P	L N	Period.	Authority	Motion
1770 (1)	$1^\circ 30'$	$356.$	132	Y_{18} 5 58 5 42 5 60 927 0	Lexell and Burckhardt. Pingré Clausen and Leverrier Asclepi and Boscowitch	Dir
1743 (1)	$2^\circ 15'$	93	68	5.46	Clausen.	Dir
1844 (1)	$3^\circ 0'$	342	64	5 47	Brünnow (same as 1678)	Dir
1585	$5^\circ 0'$	10	38	5 17 15 5	Laugier and Mauvais. Hind.	Dir.
1766 (2)	$8^\circ 0'$	251.	74.	5 0	Burckhardt.	Dir.

TABLE I.—Elliptic Orbits—*continued*

Comets	Inclination	L. P.	L. N.	Period	Authority.	Motion
1819 (4)	0 0	0 67	0 77	Yrs 4 81	Encke.	Dir
1819 (3)	11 0	291	115.	2 37	Do.	Dir
		275.	113	5.65	Do.	
1843 (3)	11 15	50	209	7 2	Nicolai.	Dir
Encke	13 15	157	335			Dir
Biela	13 30	108.	243	6 6		Dir.
Halley	17 45	304	55	76		Ret
1847 (5)	19 0	79.	310	75 0	d'Arrest.	Dir.
				125.0	Quirling and Niebour.	
1846 (7)	29 15	162	262	401.0	Wichmann	Ret
				500 0	Oudemans.	
1846 (3)	30 30	116	103	4.86	Willgen	Dir
				5 62	Hind	
1846 (6)	30 30	240	260.	12 85	C. H. A. Peters	Dir
				15 89	d'Arrest.	
1811 (2)	31 15	47.	93	875 0	Nicolai.	† Dir
1847 (3)	32 45	21.	76.	13918 0	Schweizer	† Ret
1825 (4)	33 30	318.	216.	146 0	Rumker	† Ret
				382 0	Hansen.	
				556 0	Do	
				4386 0	Do.	
1843 (1)	36 0	278.	359	175.0	Laugier and Mauvais.	* Ret.
				147 33	Bogulowski	
				35 1	Laugier and Mauvais.	
				21 83	Clausen	
1826 (2)	40 45	115.	198.	265 0	Do	* Dir.
1769	40 45	144	175.	from 449 0	Lexell	† Dir.
				to 519 0		
				1231 0	Pingré.	
				2090 0	Bessel.	
1815	44 30	149	83	72 5	Nicolai	Dir
				73.0	Nicollet.	
				74 0	Bessel.	
				75 0	Nicolai	
				77 0	Gauss.	
1783	45 0	50.	55.	5 61	Burckhardt.	Dir.
	47 0			10 0	Do	

* Rejected on account of hyperbolic elements having been found, which represent the observations tolerably well

† Rejected on account of the presumed period exceeding 500 years

TABLE I.—Elliptic Orbits—*continued*

Comets.	Inclination	L P	L N	Period	Authority	Motion
1744	° 47 °	° 197.	° 46.	Yrs 21808 25	Pingré	† Dir
				122683.0	Euler.	
1846 (1)	47 30	89.	111.	2721.0	Jelmeck.	† Dir
1793 (2)	48 °	86.	359.	12.0	Burckhardt	Dir
1847 (1)	48 30	276.	22.	608 °	Quirling and Y Vil- larceau	† Dir
				11991.0	Graham	
1845 (3)	49 °	262	337	250 °	d'Arrest.	Ret
1846 (8)	49 30	98	5	1381 °	Quirling	† Dir
1822 (4)	52 30	272.	93	194 °	Encke.	† Ret.
				1817 °	Rumker	
				1554.0	Encke	
				5449 °	Do.	
1780 (1)	54 °	246	124.	75314 °	Clunen	† Ret
1827 (3)	54 °	251.	150	2611 °	Do.	† Ret.
1845 (2)	54 15	195	348.	33.07	Clausen	* Dir
1840 (4)	58 °	23	249.	344 °	Gotze	Dir.
				359 °	Do.	
1840 (2)	59 °	80	237	13864 °	Plantamour	† Ret.
1680	61 °	263	272.	170 5	Euler	† Dir
				575 °	Halley.	
				8814 °	Encke	
				15864 °	Pingré	
1773	61 15	75	121	2081.0	Lexell	† * Dir.
				2279.0	Pingré	
				3527 °	Lexell	
1807	63 °	271.	267	1483 °	Bessel	† Dir
1849 (3)	67 °	267	31.	8368 °	d'Arrest.	† * Dir
1763	73 °	85.	356	7344 °	Burckhardt.	† Dir.
1811 (1)	73 °	75	140	510 °	Flaugergues.	† Ret.
				3056 °	Conti.	
				3065 °	Argelander	
				3383 °	Bessel.	
1812	74 °	93.	253	70 7	Encke	Dir
1683	84 °	86.	173	190 °	Clausen	Ret
1846 (4)	85 °	90	77.	55 4	Hind	Dir.
				73.0	Dicnse Mean of two	
				95.0	Peirce.	
				757 °	II Breen.	

TABLE II.—Comets whose revolutions are known or supposed to be under 500 years, arranged in Quadrants of the Longitude of Perihelion, commencing with from Longitude 45° to 135° , and in the order of their inclinations in each Quadrant

		Ascending Node, First Quadrant	Ascending Node, Second Quadrant	Ascending Node, Third Quadrant	Ascending Node, Fourth Quadrant
L P FIRST QUADRANT					
1743 (1)	D	1743 (1)			
1819 (4)	D.	1819 (4)			
1843 (3)	D.		1843 (3)		
Biela	D.			Biela.	
1847 (5)	D.			1847 (5)	
1846 (3)	D.	1846 (3)			
1783	D	1783			
1793 (2)	D.				1793 (2)
1812	D.			1812	
1683	R.		1683		
1846 (4)	D.	1846 (4)			
L P SECOND QUADRANT					
Encke	D.				Encke.
1846 (7)	R.			1846 (7)	
1815	D	1815			
L P THIRD QUADRANT					
1766 (2)	D.	1766 (2)			
1819 (3)	D	1819 (3)			
Halley	R	Halley.			
1846 (6)	D.			1846 (6)	
1845 (3)	R.				1845 (3)
L. P. FOURTH QUADRANT					
1770 (1)	D.	1770 (1)			
1844 (1)	D.	1844 (1)			
1585	D.				1585
1840 (4)	D.			1840 (4)	
L P FIRST QUADRANT					
Total,	10 D.	Total, 5 D.	Total, 1 D	Total, 3 D	Total, 1 D.
Do.	1 R.		Total, 1 R.		
L. P. SECOND QUADRANT					
Total,	2 D.	Total, 1 D.			Total, 1 D.
Do.	1 R.			Total, 1 R.	

TABLE II.—continued

	Ascending Node, First Quadrant	Ascending Node, Second Quadrant	Ascending Node, Third Quadrant.	Ascending Node, Fourth Quadrant
L P. THIRD QUADRANT				
Total, 3 D.	Total, 2 D.		Total, 1 D.	
Do. 2 R.	Do. 1 R			Total, 1 R.
L P. FOURTH QUADRANT.				
Total, 4 D	Total, 2 D		Total, 1 D	Total, 1 D.
Do 0				
23	11	2	6	4

TABLE III — Planets arranged in Same Quadrants as in preceding Table

	Ascending Node, First Quadrant.	Ascending Node, Second Quadrant	Ascending Node, Third Quadrant	Ascending Node, Fourth Quadrant.
L P FIRST QUADRANT				
Mercury	Mercury			
Venus	Venus			
Earth.				
Juno		Juno		
Pallas		Pallas		
Metis.	Metis			
Egeria				Egeria.
Eunomia.			Eunomia.	
Saturn	Saturn			
L P. SECOND QUADRANT				
Ceres.	Ceres.			
Astræa.		Astræa.		
Irene.	Irene			
Uranus	Uranus.			
L P THIRD QUADRANT				
Vesta.	Vesta			
Hygeia.			Hygeia.	
Victoria.			Victoria.	

TABLE III.—*continued*

	Ascending Node, First Quadrant	Ascending Node, Second Quadrant	Ascending Node, Third Quadrant	Ascending Node, Fourth Quadrant
L P FOURTH QUADRANT				
Mars.	Mars.			
Hebe.		Hebe.		
Iris			Iris	
Flora.	Flora.			
Parthenope.	Parthenope.			
Jupiter.	Jupiter.			
Neptune.	Neptune.			
L P FIRST QUADRANT				
Total, 9	Total, 4	Total, 2	Total, 1	Total, 1
L P SECOND QUADRANT				
Total, 4	Total, 3	Total, 1		
L P THIRD QUADRANT				
Total, 3	Total, 1		Total, 2	
L. P. FOURTH QUADRANT				
Total, 7	Total, 5	Total, 1	Total, 1	
23	13	4	4	1

Having found that all the ascending nodes of the zodiacal planets were situated in longitude between 45° and 135° , I selected that division of the circle, as in the tables 2 and 3, into quadrants, for my proposed comparisons. Of course it is purely accidental that the number of comets in Table 2 happens to be the same as the number of known planets at the period of comparison in January, 1852, but the circumstance favours the inquiry. Let us group the results as follows :

TABLE IV.—L. P.'s of Comets

Between	0° 45 and 135°	.	.	.	11	} 15
„	135 and 225	.	.	.	3	
„	225 and 315	.	.	.	5	
„	315 and 45	.	.	.	4	
					<hr/> 23	

TABLE IV.—*continued.*

<i>Ascending Nodes</i>				
Between	⁰ 45 and ⁰ 135	.	.	11
„	135 and 225	.	.	2
„	225 and 315	.	.	6
„	315 and 45	.	.	4
				<hr/> 23

L. P 's of Planets

Between	⁰ 45 and ⁰ 135	.	.	9	} 16
„	135 and 225	.	.	4	
„	225 and 315	.	.	3	
„	315 and 45	.	.	7	
				<hr/> 23	

Ascending Nodes.

Between	⁰ 45 and ⁰ 135	.	.	13	} 14
„	135 and 225	.	.	4	
„	225 and 315	.	.	4	
„	315 and 45	.	.	1	
				<hr/> 22	

There is surely herein something to demand attention ; perhaps more : the consideration of those best qualified to penetrate into the still hidden mysteries of the universe. I do not presume so far, but I think that the above facts add some other probabilities to those already noticed by Sir J. Herschel ; viz. : that direct motion and a small inclination are favourable indications of a periodic comet. May we not add now, a L. P. and L. ascending node being found between 45° and 135° ?

Should astronomers generally acquiesce in the conclusion arrived at by M.M. Laugier and Mauvais, that the comet of 1844 (1) is identical with those of 1743 (1), 1585, 1766 (2), and 1819 (3) or (4), which have been here assumed to be distinct bodies, it would modify the results, but nevertheless leave the features of resemblance between cometary and planetary orbits generally as they have been represented. However, considering the view of M.M. Laugier and Mauvais, it may be remarked, that, with reference to the comet 1743 (1), the observations made were so few and defective that it would be difficult to place confidence in any orbit, and perhaps on this account it should be omitted altogether. M.M. Leveurier and Schumacher were opposed to any ellipse

being assigned to the comet of 1585. Again, the notes on that of 1766 (2) seem to indicate that but little reliance can be placed on any orbit, and I cannot help feeling that there are also grounds of distrust, for purposes of analogical inquiry, in the comets 1819 (4), 1783, 1793 (2), 1846 (4), 1846 (6), 1819 (3). If we reject all these, and confine our limit to a period of 150 years, the result will be

TABLE V —L. P.'s of Comets (*period not more than 150 years*).

Between 45° and 135°	.	6	} 8
„ 135° and 225°	.	2	
„ 225° and 315°	.	1	
„ 315° and 45°	.	2	
		<hr/> 11	

Ascending Nodes

Between 45° and 135°	.	6	} 7
„ 135° and 225°	.	1	
„ 225° and 315°	.	3	
„ 315° and 45°	.	1	
		<hr/> 11	

Two new Planets having been recently discovered, it may be advisable to show how Tables 3 and 4 would stand after their introduction. Adding Psyche and Thetis to Table 3 we shall have

L P 1st Quadrant, 9	8 1st Quadrant, 14
„ 2nd Quadrant, 4	„ 2nd Quadrant, 5
„ 3rd Quadrant, 5	„ 3rd Quadrant, 4
„ 4th Quadrant, 7	„ 4th Quadrant, 1
<hr/> 25	<hr/> 24

TABLE 4th—The result will be

L P 315° to 135° = 16	8 = 15
„ 135° to 315° = 9	= 9

DISCOVERERS
OF THE
APPARITIONS OF COMETS.

No. Discovered.	Names.	Comets.
1	Blanchini, . . .	1684.
1	Biela, . . .	1826 (1).
3	Bogulowski, . . .	1835 (1), 1835 (2), 1838.
1	Bond, . . .	1850 (2).
2	Bouvard, . . .	1797, 1798 (2).
1	Bradley, . . .	1757.
1	Bremicker, . . .	1840 (4).
5	Brorsen, . . .	1846 (3), 1846 (7), 1847 (5), 1851 (3), 1851 (4).
1	Cassini and Maraldi, . . .	1706.
1	Challis, . . .	1851 (1).
1	Cheseaux, . . .	1747.
2	Colla, . . .	1845 (3), 1847 (2).
1	d'Abbadie, . . .	1830 (1)
2	d'Arrest, . . .	1845 (1), 1851 (2)
8	de Vico, . . .	1844 (1), 1845 (2), 1845 (4), 1846 (1), 1846 (2), 1846 (4), 1846 (5), 1846 (8).
1	Dumouchel, . . .	1835 (3).
1	Dunlop, . . .	1833.
1	Faye, . . .	1843 (3).
2	Flaugergues, . . .	1811 (1), 1826 (3).
1	Fontenay, . . .	1699.
3	Galle, . . .	1840 (1), 1840 (2), 1840 (3)
4	Gambart, . . .	1822 (1), 1825 (1), 1832 (2), 1834.
1	Goujon, . . .	1849 (2).
1	Grischow, . . .	1743 (1).
1	Helfenzrieda, . . .	1766 (2)
1	Henderson, . . .	1832 (1)
1	Hera path, . . .	1830 (2)
6	Herschel, Miss C.	1786 (2), 1788 (2), 1790 (1), 1790 (3), 1792 (1), 1795
1	Hesse, Landgrave of, and Rothmann, . . .	1585.
2	Hevelius, . . .	1672, 1677
3	Hind, . . .	1846 (5), 1847 (1), 1848 (2).

No Discovered	Names	Comets.
1	Hire la, . . .	1678
1	Jacob, . . .	1695
1	Kirch, . . .	1718
3	Klunkenberg, . . .	1744, 1748 (2), 1762
1	Laugier, . . .	1842 (2)
3	Mauvais, . . .	1843 (2), 1844 (2), 1847 (4)
10	Méchain, . . .	1781 (1), 1781 (2), 1785 (1), 1785 (2), 1786 (1), 1787, 1790 (2), 1792 (2), 1799 (1), 1799 (2).
14	Messier, . . .	1759 (2), 1763, 1764, 1766 (1), 1769, 1770 (1), 1771, 1773, 1779, 1780 (1), 1785 (1), 1788 (1), 1793 (1), 1798 (1)
1	Mitchell, Miss, . . .	1847 (6)
1	Möestlin, . . .	1580.
3	Montagne, . . .	1772, 1774, 1780 (2).
1	Nux de la, . . .	1758.
2	Olbers, . . .	1796, 1815.
1	Pallu, . . .	1701
1	Perny, . . .	1793 (2)
1	Peters, C. N. F., . . .	1846 (6).
3	Petersen, . . .	1848 (1), 1849 (1), 1850 (1).
1	Pigott, . . .	1783.
29	Pons, . . .	1802, 1804, 1805 (2), 1806, 1807, 1808 (1), 1808 (2), 1810, 1811 (2), 1812, 1813 (1), 1813 (2), 1818 (1), 1818 (2), 1818 (3), 1819 (1), 1819 (3), 1819 (4), 1821, 1822 (3), 1822 (4), 1825 (2), 1825 (4), 1826 (2), 1826 (4), 1826 (5), 1827 (1), 1827 (2), 1827 (3).
1	Reissig, Jun., . . .	1801.
1	Richaud, . . .	1689
1	Rissen, C. J. de, . . .	1593
2	Rümker, . . .	1822 (2), 1824 (1)
1	Sarabat, . . .	1729
1	Scheithausen, . . .	1824 (2).
2	Schweizer, . . .	1847 (3), 1849 (3)
1	Stancari and Manfredi, . . .	1707
1	Struve, . . .	1828.
1	Thuhs, . . .	1805 (1)
1	Tralles, . . .	1819 (2)
2	Valz, . . .	1825 (3), 1842 (1).
1	Wilmot, . . .	1844 (3).
1	Zanotti, . . .	1739

CATALOGUE.

No.	Perihelion Passage Greenwich Mean Time	•	Longitude of Perihelion.	Longitude of Node	Inclination
	OLD STYLE.				
1	—371, Winter,		150° to 210°	270° to 330°	above 30°
2	—137, April, 29.		230	220	20
3	—69, July,		315	165	70
4	—12, Sept, 15		0	35	67
5	66, Jan., 14 2		325 0'	32 42'	40 30'
6	240, Nov, 10		271	189	44
7	451, July, 3 5		Halley's	Comet.	
8	539, Oct, 20.62		313 30	58 or 238	10
9	565, July, 9.		88	158	62
	July, 14 5		80	159 30	59
10	568, Aug, 29 32		318 35	294 15	4 8
	Aug, 28 27		316 47	294 36	4 2
11	574, April, 7 28		143 39	128 17	46 31
(7)	760, June, 11.		Halley's	Comet.	
12	770, June, 6 64		2 8	88 54	59 31
	June, 6 588		357 7	90 59	61 49
13	837, March, 1		289 3	206 33	10 to 12
14	961, Dec. 30 16		268 3	350 35	79 33
15	989, Sept, 12		264	84	17
16	1066, May, 30 or 31		120	230	70 to 80
17	1092, Feb., 15.		156 20	125 40	28 55
18	1097, Sept., 21 9		332 30	207 30	73 30
19	1231, Jan., 30 3		134 48	13 30	6 5
20	1264, July, 6 33		291	169	36 30
	July, 16.		272 30	175 30	30 25
	July, 17 25		275 45	178 45	30 25
21	1299, March, 31 312		3 20	107 8	68 57
22	1301, Sept., beginning,		180	60	80
	Oct., 22		270	15	70
•	Oct, 24		312	138	13

Logarithm Per distance.	Eccentricity	Dir of Mot	Calculator.	Authority.
very small,	1.	R	Pingré,	P. i—261, 262.
0.0043	1	R.	Peirce,	Amer. Alm., 1847.
9 90	1.	D.	Peirce,	Amer. Alm., 1847.
9.949	1	R.	Peirce,	Amer. Alm., 1847.
9.6480	1.	R.	Hind,	A. N xxvii, 157.
9 570	1	D.	Burckhardt,	M. C. x—167
			Laugier,	C. R xxiii, 187.
9.53307	1.	D.	Burckhardt,	M C, 11, 415, xvi, 498.
9.85686	1	R.	Burckhardt,	M. C., x, 163
9 92000	1.	R.	Burckhardt,	M. C, x, 163.
9 95779	1.	D	Laugier,	C. R, xxii, 156
9.9491	1.	D.	Hind,	A. N, xxi, 282.
9.9836	1.	D	Hind,	A. N, xxi, 282.
			Laugier,	C R, xxiii, 186.
9 7801	1	R	Hind,	A. N., xxiii, 377.
9 80766	1.	R.	Laugier,	C R, xxii, 156
9 763428	1	R	Pingré,	P, i, 345
9 7418	1	R	Hind,	A. N., xxiii, 377.
9.7546	1.	R	Burckhardt,	M. C., x, 167
9 53	1	R.	Pingré,	P., i, 377
9.9676	1	D.	Hind,	A. N, xxvii, 157
9 86832	1	D.	Burckhardt,	M C., 11, 417, xvi, 503
9.976698	1.	D	Pingré,	P., 1, 402
9.64836	1.	D.	Dunthorne,	M A, 1760, 192; and P. T Ab, x, 210.
9.633469	1.	D.	Pingré,	M. A, 1760, 192.
9.61364	1	D.	Pingré,	M. A., 1760, 192.
9 50233	1	R.	Pingré,	P., i, 419
9 523	1.	D.	Burckhardt,	M. C, x, 165.
9 660	1	R.	Pingré,	P, 1, 423
9 806	1.	R.	Laugier,	C. R, xv, 950.

No	Perihelion Passage Greenwich Mean Time	Longitude of Perihelion	Longitude of Node	Inclination
23	1337, June, 2 267 June, 1.021 June, 15.074 June, 22.796	0 ' 37 59 20 2 20 350 22	0 ' 84 21 66 22 93 1 99 6	0 ' 32 11 32 11 40 28 42 54
24	1351, Nov, 26.5	69	Indeterminate,	Indeterminate,
25	1362, March, 11 20 March, 2.33	219 227	249 237	21 32
26	1366, Oct., 13.	66	212	6
(7)	1378, Nov., 8 764	299 31	47 17	17 56
27	1385, Oct, 16.26	101 47	268 31	52 15
28	1433, Nov, 4 42 Nov, 5 19	281 2 262 1	133 40 110 9	79 1 77 14
(7)	1456, June, 8 917	301	48 30	17 56
29	1457, Sept., 3.7	92 50	256 5	20 20
30	1468, Oct., 7.4095 Oct., 7.4265	356 3 1 22	61 15 71 5	44 19 38 1
31	1472, Feb, 28.933 Feb., 28 218	45 33 30" 48 3	281 46 20" 207 32	5 20 0" 1 55
32	1490, Dec., 24 47 Dec, 35 9	58 40 113	288 45 268	51 37 75
33	1506, Sept. 3 662	250 37	132 50	45 1
(7)	1531, Aug., 24.888 Aug., 25.792	301 39 301 12	49 25 45 30	17 56 17 0
34	1532, Oct, 19 925 Oct, 19 620 Oct., 18 3324	111 7 135 44 111 48	80 27 119 8 87 23	32 36 42 27 32 36
35	1533, June, 16.813 June, 14 883	104 12 217 40	125 44 299 19	35 49 28 14
(20)	1556, April, 21 835 April, 21.8012 April, 22 0233	278 50 267 37 42 274 14 54	175 42 176 33 48 175 25 48	32 6 30 36 11 24 30 12 42
36	1558, Aug., 10.52	329 49	332 36	73 29

Logarithm Per distance	Eccentricity.	Dir. of Mot	Calculator.	Authority.
9 609236	I.	R.	Halley,	Miscell. Curiosa, 327.
9 80924	I.	R.	Fingré,	P., 1, 432.
9 91815	I.	R.	Laugier,	C. R., xxii, 153.
9.97162	I.	R	Hind,	A. N., xxi, 282.
0	I.	D.	Burckhardt,	M. C., ii, 418.
9 65875	I.	R.	Burckhardt,	M. C., x, 166.
9 67214	I	R.	Burckhardt,	M. C., x, 166.
9 9814	I		Peirce,	Amer. Alm., 1847
9 76604	I	R	Laugier,	C. R., xvi, 1003
9 8886	I.	R	Hind,	A. N., xxi, 282.
9 53079	I.	R.	Laugier,	C. R., xxi, 151.
9.5166	I	R	Hind,	Olb Abh (E)
9 76734	I	R	Fingré,	P., i, 460.
0 3229	I.	D.	Hind,	A. N., xxvii, 157
9 93109	I	R	Laugier,	C. R., xxi, 150
9 91893	I.	R	Valz,	C. R., xxii, 425.
9 734584	I.	R	Halley,	Miscell Curiosa, 327.
9 751718	I	R.	Laugier,	C. R., xxi, 152
9 8678	I.	D	Hind,	A. N., xxiii, 377
9 878	I.	R.	Peirce,	Amer. Alm., 1847.
9.58656	I	R	Laugier,	C. R., xxi, 154.
9.753583	I.	R.	Halley,	Miscell Curiosa, 327.
9 76338	0 967391	R.	Halley,	Olb. Abh. (E)
9 706803	I.	D	Halley,	Miscell. Curiosa, 327
9 787141	I	D.	Méchain,	Olb Abh. (E).
9 715331	I	D.	Olbers,	Olb. Abh (E)
9.307068	I.	R	Douwes,	A. J., 1800, 126.
9 514362	I.	D	Olbers,	A. J., 1800, 130
9.666424	I	D	Halley,	Miscell. Curiosa, 327
9.75246	I	D	Hind,	A. N., xxi, 196
9.70323	I	D	Hind,	A. N., xxvii, 159.
9 76140	I.	R	Olbers,	A. J., 1817, 183

No.	Perihelion Passage Greenwich Mean Time	Longitude of Perihelion	Longitude of Node	Inclination
37	1577, Oct., 26 781 Oct, 26 9476	0 ' " 129 22 " 129 42 0	0 ' " 25 52 " 25 20 24	0 ' " 74 32 45 75 9 42
38	1580, Nov, 28.625 Nov, 28 5727	109 5 50 109 11 55	18 57 20 19 7 37	64 40 0 64 51 50
39	1582, May, 6 6664 May, 7 348	245 23 10 281 26 45	231 7 20 214 42 35	61 27 50 59 29 5
	NEW STYLE.			
40	1585, Oct, 7 806 Oct., 8.09264	8 51 10 56 8	37 42 30 38 13 9	6 4 4 34 8
	Oct, 7 96242 Oct., 8 11619 Oct, 8 0262	9 51 7 9 15 29 9 8 21	37 57 48 37 43 52 37 44 10	5 25 5 6 5 4 6 5 52
41	1590, Feb., 8.156 Feb, 8 0271	216 54 30 217 57 21	165 30 40 165 37 5	29 40 40 29 29 44
42	1593, July, 18.5685	176 19	164 15	87 58
43	1596, Aug., 10.830 Aug., 8.6484 July, 25 2143 July, 23.612	228 16 238 30 50 270 54 38 274 24	312 12 30 315 36 50 330 20 52 335 39	55 12 52 9 45 51 58 10 52 48
(7)	1607, Oct, 26 160 Oct, 26.906 Oct, 26.71594	302 16 301 3 40 301 38 10	50 21 47 48 40 43 40 28	17 2 17 20 17 12 17
44	1618 (1), Aug., 17.1268	318 20	293 25	21 28
45	1618 (2), Nov, 8 516 Nov, 8 3507	2 14 3 5 21	76 1 75 44 10	37 34 37 11 31
46	1652, Nov, 12 653	28 18 40	88 10	79 28
47	1661, Jan., 26 987 Jan, 26 881	115 58 40 115 16 8	82 30 30 81 54 0	32 35 50 33 0 55
48	1664, Dec, 4 494	130 41 25	81 14 0	21 18 30
49	1665, April, 24.219	71 54 30	228 2	76 5
50	1668, Feb, 24 782 Feb., 28 8	40 9 277 2	193 26 357 17	27 7 35 58
51	1672, March, 1.359	46 59 30	297 30 30	83 22 10

Logarithm Per distance	Eccentricity	Dh of Mot.	Calculator.	Authority.
9 263447	I	R.	Halley,	Miscell Curiosa, 327.
9 24920	I.	R.	Wolstedt,	A. N., xxiv, 8
9 775450	I.	D.	Halley,	Miscell. Curiosa, 327.
9 774903	I.	D	Pingré,	P., i, 540.
9.353522	I.	R	Pingré,	P., i, 549.
8 602754	I.	R	Pingré,	P., i, 550
0.038850	I	D	Halley,	Miscell. Curiosa, 327
0 0272587	0 6439006	D.	Laugier and Mauvais,	C. R, xix, 702.
0 0335458	0.8262095	D	Hind,	A. N, xxiii, 378.
0 0395755	I.	D	Leverrier,	A. N., xxvi, 381.
0.0393530	I.	D.	C A. Peters and Sawitsch,	A. N, xxix, 269
9 760882	I.	R	Halley,	Miscell Curiosa, 327.
9 7541386	I.	R	Hind,	A. N, xxv, 131.
8 949940	I.	D.	Lacaille,	M. A., 1747, 562
9.710058	I.	R	Halley,	Miscell Curiosa, 327
9.739908	I.	R	Pingré,	P, i, 567
9 7537024	I.	R	Hind,	A. N., xxiii, 232
9 75258	I.	R.	Valz,	A. N, xxiii, 385.
9.768490	I.	R	Halley,	Miscell Curiosa, 327
9 767208	0 967391	R	Halley,	Olh. Abh. (E).
9 769358	0 9670887	R	Bessel,	M. C., x, 438.
9.71010	I.	D	Pingré,	P, ii, 100
9 579498	I.	D	Halley,	Miscell Curiosa, 327.
9 590556	I	D	Bessel,	A. J, 1808, 119.
9.928140	I.	D	Halley,	Miscell. Curiosa, 327
9 651772	I	D	Halley,	Miscell Curiosa, 327.
9.646131	I	D	Méchain,	Olh. Abh. (E).
0 011044	I.	R	Halley,	Miscell. Curiosa, 327
9 027309	I.	R.	Halley,	Miscell Curiosa, 327.
9.39990	I	D	Henderson,	A N, xx, 334
7.68000	I	R	Henderson,	A N., xx, 335
9 843476	I	D.	Halley,	Miscell. Curiosa, 327.

No.	Perihelion Passage Greenwich Mean Time	Longitude of Perihelion	Longitude of Node	Inclination
52	1677, May, 6.026	° ' " 137 37 5	° ' " 236 49 10	° ' " 79 3 15
53	1678, Aug., 26.586	327 46	161 40	3 4 20
54	1680, Dec, 18.004	262 39 30	272 2	60 56
	Dec, 17.965	262 44 25	272 2	61 6 48
	Dec, 17 86017	263 26 48	272 59 9	58 39 50
	Dec., 18 003	263 15	271 53	61 20 20
	Dec., 18.00070	262 40 10	271 57 13	61 22 55
	Dec., 17 99348	262 49 19	272 9 33	60 38 37
	Dec, 17 99038	262 49 5	272 9 29	60 40 16
(7)	1682, Sept., 14.319	302 52 45	51 16 30	17 56
	Sept, 14.890	301 36	50 48	17 42
	Sept., 14 8032	301 49	50 44	17 46 30
	Sept, 14, 73350	302 3 45	51 17 10	17 48 0
	Sept, 14.80789	301 51 2	50 57 59	17 44 47
	Sept., 14 79505	301 55 37	51 11 18	17 44 45
55	1683, July, 13 118	85 29 30	173 23	83 11
	July, 12.72586	86 31 42	173 18 15	83 47 46
56	1684, June, 8 428	238 52	268 15	65 48 40
57	1686, Sept., 16.606	77 0 30	350 34 40	31 21 40
58	1689, Dec., 1 6220	263 44 45	323 45 20	69 17
	Dec., 2 1403	271 16	344 18	30 25
59	1695, Nov., 9.7018	60	216	22
60	1698, Oct., 18.706	270 51 15	267 44 15	11 46
61	1699, Jan., 13.349	212 31 6	321 45 35	69 20
62	1701, Oct, 17.410	133 41	298 41	41 39
63	1702, March, 13.592	138 41 3	189 25 15	4 30
	March, 13.6065	138 46 34	188 59 10	4 24 44
64	1706, Jan, 30 1824	72 29 10	13 11 40	55 14 10
	Jan., 30.2060	72 36 25	13 11 23	55 14 5
65	1707, Dec, 11.9789	79 54 56	52 46 35	88 36 0
	Dec., 11.9885	79 58 9	52 50 29	88 37 40
66	1718, Jan., 14.9852	121 30	128 43	30 20
	Jan., 15.05225	121 26 36	127 55 20	31 12 53

Logarithm For distance.	Eccentricity.	Dir. of Mot.	Calculator.	Autherity.
9 448072	1.	R	Halley,	Miscell. Curiosa, 327.
0 092727	1.	D.	Douwes,	P., II, 100.
7.787106	1.	D.	Halley,	Miscell. Curiosa, 327.
7.790611	0.999910704	D.	Halley,	Princip., III, prop 41, prob 21.
7 817202	0.999786506	D.	Euler,	P., II, 26, 109.
7 7723	1.	D.	Newton,	Princip , III, prop. 21, prob 21
7 780295	0 9999904496	D	Pingré,	P., II, 26, 102
7 7947604	1	D	Encke,	Olb. Abh. (E).
7.7939551	0 999985417	D	Encke,	Olb. Abh. (E).
9 765877	1.	R	Halley,	Miscell Curiosa, 327.
9.765296	0.9673915	R.	Halley,	P., II, 102, rev. 75½ yrs
9.764975	1.	R.	Bailly,	A. J , 1828, 149.
9.7654444	0.9676763	R.	Burckhardt,	Conn Temps., 1819, 375
9.7654650	0 96792941	R.	Rosenberger,	A N., XI, 177.
9 7655898	0.96792019	R.	Rosenberger,	A. N , XII, 190
9.748343	1.	R.	Halley,	Miscell. Curiosa, 327.
9.7430148	0 9832470	R.	Clausen,	A. N., V, 367
9 982339	1.	D.	Halley,	Miscell Curiosa, 327.
9 511883	1.	D.	Halley,	Miscell. Curiosa, 327.
8 227604	1.	R.	Pingré,	P , II, 102.
8 01284	1.	R	Peirce,	A N., XX, 396.
9.9261	1.	D.	Burckhardt,	Conn.Temps., 1817, 278
9.839660	1.	R.	Halley,	Miscell Curiosa, 327
9.871570	1.	R.	Lacaille,	Olb. Abh. (E)
9 772784	1.	R.	Burckhardt,	A J., 1813, 223.
9 810165	1.	D.	Lacaille,	P., II, 102.
9 81079	1.	D.	Burckhardt,	M C , XVI, 511.
9 629218	1.	D.	Lacaille,	P., II, 102.
9.630290	1.	D	Struyck,	P , II, 102.
9.934368	1	D.	Lacaille,	P , II, 102.
9 934013	1.	D.	Struyck,	P , II, 102.
0.011380	1.	R	Lacaille,	P., II, 102
0 010999	1.	R.	Douwes,	P., II, 102.

No.	Perihelion Passage Greenwich Mean Time	Longitude of Perihelion	Longitude of Node	Inclination
66	1718, Jan., 15.3254	0° 3' 40"	128° 21' 0"	30° 48' 30"
	Jan., 14 90573	121° 39' 57"	127° 55' 31"	31° 8' 6"
67	1723, Sept., 27 6736	42° 52' 20"	14° 16' 0"	49° 59' 0"
	Sept., 27 76170	42° 55' 46"	14° 23' 24"	49° 55' 0"
	Sept., 27 87350	42° 35' 12"	14° 10' 2"	49° 55' 25"
	Sept., 27 62788	42° 52' 35"	14° 14' 17"	50° 0' 18"
68	1729, June, 23.27505	322° 16' 54"	310° 35' 15"	77° 1' 58"
	June, 25 4560	322° 40' 0"	310° 32' 37"	76° 58' 4"
	July, 22 98957	327° 21' 38"	310° 16' 46"	76° 42' 45"
	May, 22 44662	316° 26' 48"	310° 51' 43"	77° 18' 54"
	June, 25 3831	322° 37' 3"	310° 32' 55"	77° 1' 0"
	June, 13 26350	320° 31' 22"	310° 38' 0"	77° 5' 18"
	June, 12.74350	320° 27' 36"	310° 38' 0"	77° 5' 18"
69	1737 (1), Jan., 30 34767	325° 55'	226° 22'	18° 20' 45"
70	1737 (2), June, 8 3185	262° 36' 39"	123° 53' 43"	39° 14' 5"
71	1739, June, 17 4567	102° 34'	207° 18'	55° 53'
	June, 17.4164	102° 38' 40"	207° 25' 14"	55° 42' 44"
72	1742, Feb., 8 1814	217° 33' 44"	185° 34' 45"	67° 4' 11"
	Feb., 8 1935	217° 35' 13"	185° 38' 29"	66° 59' 14"
	Feb., 7 1768	220° 49' 23"	189° 32' 7"	61° 43' 44"
	Feb., 7 9102	217° 33' 28"	185° 47' 22"	68° 14' 0"
	Feb., 8 2213	217° 26' 23"	185° 29' 28"	67° 11' 9"
	Feb., 8 3004	217° 37' 50"	185° 41' 32"	66° 51' 0"
	Feb., 8.6192	216° 39' 20"	185° 9' 30"	67° 31' 40"
73	1743 (1), Jan., 10 88583	92° 58' 4"	68° 10' 48"	2° 15' 50"
	Jan., 10 89414	92° 41' 45"	78° 21' 15"	2° 19' 33"
	Jan., 8.19403	93° 19' 37"	86° 54' 30"	1° 53' 43"
	Jan., 10 84740	92° 57' 51"	67° 31' 57"	2° 16' 16"
74	1743 (2), Sept., 20 8866	246° 33' 52"	5° 16' 25"	45° 48' 21"
75	1744, March, 1 3451	197° 12' 55"	45° 45' 20"	47° 8' 36"
	March, 1 3435	197° 5' 49"	45° 46' 53"	47° 3' 35"
	March, 1 3359	197° 10' 0"	45° 46' 11"	47° 5' 18"
	March, 1.3299	197° 17' 30"	45° 51' 0"	47° 18' 0"
	March, 1 3741	197° 19' 26"	46° 5' 24"	47° 49' 53"
	March, 1.3282	197° 11' 58"	45° 46' 6"	47° 10' 53"

Logarithm Per distance	Eccentricity.	Dir. of Mot	Calculator.	Authority.
0 011753	I.	R	Whiston,	Olb Abh (E).
0 010908	I.	R	Argelander,	A N , vii, 493.
9.999414	I.	R.	Bradley,	P T Ab , vii, 14
9.9991872	I.	R.	Burckhardt,	Conn.Temps., 1821, 296
9 9998700	I.019956	R.	Burckhardt,	Conn.Temps, 1821, 296
9 9994743	I.	R.	Sporer,	Olb. Abh (E).
0.609573	I.	D.	Douwes,	P , ii, 102.
0 629552	I.	D.	Lacaille,	Olb Abh (E).
0.620060	I.	D	Maraldi,	M A., 1743, 196
0 596517	I.	D.	Kies,	Olb. Abh. (E).
0.610835	I.	D.	Dehse,	M. A , 1746, 406.
0.6067570	I.0050334	D.	Burckhardt,	Olb Abh (E).
0.6067145	I.	D.	Burckhardt,	Olb. Abh. (E).
9.347960	I.	D.	Bradley,	P T. Ab , viii, 152
9 93802	I.	D.	Daussy,	Olb Abh (E).
9.827111	I	R	Zanotti,	P , ii, 102.
9.828389	I.	R	Lacaille,	P , ii, 102.
9 883976	I.	R.	Struyck,	P , ii, 102.
9.884048	I	R.	Lacaille,	P , ii, 102
9 876276	I.	R	Euler,	P., ii, 102.
9 885870	I.	R.	Wright,	P., ii, 102.
9.884342	I.	R.	Klinkenberg,	P , ii, 102.
9 883917	I.	R.	Houttuyn,	P , ii, 102.
9.886523	I.	R.	Barker,	Olb Abh. (E).
9.923303	I.	D	Struyck,	P., ii, 102.
9 921691	I	D	Lacaille,	Olb Abh. (E).
9.9352858	0 7213086	D.	Clausen,	A N , x, 345.
9.923338	I.	D.	Olbers,	A. N , ii, 379.
9 717310	I.	R.	Klinkenberg,	P , ii, 104.
9 346472	I.	D	Betts,	P T. Ab , ix, 48
9 348733	I.	D.	Maraldi,	M. A , 1744, 67.
9.347325	I.	D.	Lacaille,	M. A , 1746, 428.
9 345491	I.	D	Maie,	Olb Abh (E).
9.346296	I.	D	Chéseaux,	Olb Abh. (E).
9 346783	0.9999099963	D.	Euler,	P., ii, 54, 104.

No	Perihelion Passage Greenwich Mean Time.	Longitude of Perihelion	Longitude of Node	Inclination
		° ' "	° ' "	° ' "
75	1744, March, 1.32895	197 13 4	45 47 53	47 8 29
	March, 1.32093	197 14 36	45 49 27	47 17 38
	March, 1.33062	197 16 16	45 49 30	47 14 10
	March, 1 3268	197 29	46 3	47 50
76	1747, March, 3 41549	277 2 5	147 18 42	79 6 45
	March, 3.2991	277 2 0	147 18 50	79 6 20
77	1748 (1), April, 28.80930	215 0 50	232 52 16	85 26 57
	April, 29 01739	214 38 40	232 45 46	85 35 17
	April, 28 78065	215 23 29	232 51 50	85 28 23
78	1748 (2), June, 18.05898	276 9 24	34 39 43	56 59 3
	June, 18 88751	278 47 10	33 8 29	67 3 28
79	1757, Oct, 21.3299	122 58 0	214 12 50	12 50 20
	Oct, 21 3977	122 39 0	214 5 50	12 39 6
	Oct, 21 4074	122 49	214 4	12 48
	Oct., 21.3845	122 36 29	214 7 11	12 41 17
80	1758, June, 11 1373	267 38	230 50	68 19
(7)	1759 (1), March, 12.5581	303 14	53 48	17 38
	March, 12.53350	303 16 20	53 49 21	17 35 20
	March, 12.5560	303 15 30	53 49	17 38
	March, 12.5636	303 16	53 49	17 39
	March, 12.54043	303 19 18	53 45 35	17 40 5
	March, 13.41817	301 0 24	54 7 20	17 28 55
	March, 12 5504	303 23 0	53 44 55	17 41 20
	March, 12.58326	303 10 1	53 50 11	17 37 12
	March, 12.56461	303 10 24	53 48 0	17 38 16
	March, 12.5517	303 10 28	53 50 27	17 36 52
81	1759 (2), Nov., 27 00180	53 34 19	139 39 41	79 6 38
	Nov., 27 09651	53 24 20	139 39 24	78 59 22
	Nov., 27.02358	53 38 4	139 40 15	79 3 19
82	1759 (3), Dec., 16 8775	138 24 35	79 50 45	4 51 32
	Dec., 16 53392	139 3 52	79 20 24	4 42 10
83	1762, May, 29 01281	105 22 23	348 55 31	85 22 21
	May, 28.6373	105 15	349 20	84 45
	May, 29 0748	105 24	348 57 44	85 12 20
	May, 28.07816	103 42 38	348 35 24	85 40 10

Logarithm Per distance	Eccentricity.	Dir. of Mot	Calculator.	Authority
9 346801		D.	Pingré,	P., II, 104.
9.346353	I.	D.	Klinkenberg,	P, II, 104.
9 345875	I.	D.	Horter,	Olb. Abh. (E.)
9 343212	I.	D.	Cassini,	M. A., 1744, 306.
0 342144	I.	R.	Maraldi,	M. A., 1748, 235.
0 342146	I.	R.	Lacaille,	P, II., 104.
9 924626	I.	R.	Maraldi,	M. A., 1748, 232.
9 925054	I.	R.	Klinkenberg,	Olb Abh. (E)
9 924486	I.	R.	Lemonnier,	Olb. Abh. (E)
9 816410	I.	D.	Struyck,	A. J., 1809, 97.
9 796128	I.	D.	Bessel,	A J., 1809, 99.
9 528328	I.	D.	Bradley,	P. T. Ab., XI, 169.
9 530288	I.	D.	Lacaille,	P, II, 104
9 528875	I.	D.	Pingré,	P., II, 104.
9 530610	I.	D.	De Ratte,	M. A., 1761, 501.
9 333148	I.	D.	Pingré,	P., II, 104.
9 766080	I.	R.	Messier,	M. A., 1760, 425.
9 766115	0.9674269	R.	Maraldi,	M. A., 1759, 286.
9 766264	I.	R.	Lacaille,	M. A., 1760, 62
9 766039	I.	R.	Lacaille,	M. A., 1760, 425.
9.765648	0 9676458	R.	Klinkenberg,	M. A., 1760, 437.
9.776029	I.	R.	Klinkenberg,	M. A., 1760, 437.
9.765176	I.	R.	Bailly,	P., II, 104.
9.7668491	0 96754386	R.	Burckhardt,	Olb Abh (E)
9 7668003	0.96768426	R.	Rosenberger,	A. N., XI, 177.
9 7667990	0 96768436	R.	Rosenberger,	A. N, XII, 190
9 903844	I.	D.	Pingré,	P., II, 104
9 902280	I.	D.	Lacaille,	M. A., 1760, 151.
9 904218	I	D.	Chappe,	M. A., 1760, 169
9.984972	I.	R.	Lacaille,	M. A., 1760, 104.
9 983064	I.	R.	Chappe,	M. A., 1760, 167.
0 006102	I	D.	Maraldi,	M. A., 1762, 561
0 00538	I	D.	Lalande,	M. A., 1762, 566.
0 00460	I.	D.	Bailly,	M. A., 1763, 233.
0.002969	I.	D.	Klinkenberg,	M. A., 1762, 568.

No	Perihelion Passage Greenwich Mean Time	Longitude of Perihelion	Longitude of Node.	Inclination.
83	1762, May, 28 28574 May, 28 33451	° ' " 104 29 46 104 2 0	° ' " 349 2 22 348 33 5	° ' " 85 3 2 85 38 13
84	1763, Nov, 1.87300 Nov, 1 82195 Nov, 1 87150 Nov, 1 87380 Nov., 1 86141	85 0 48 84 51 54 84 57 27 85 1 6 84 58 58	356 29 29 356 23 26 356 17 38 356 27 0 356 24 4	72 39 29 72 40 40 72 34 10 72 28 0 72 31 52
85	1764, Feb, 12 56291 Feb., 12 57100	15 26 3 15 14 52	120 7 33 120 4 33	52 46 39 52 53 31
86	1766 (1), Feb, 17 3616	143 15 25	244 10 50	40 50 20
87	1766 (2), April, 22 86549 April, 26.98882	242 17 53 251 13	74 22 50 74 11	11 8 4 8 1 45
88	1769, Oct., 7 5143 Oct, 7.51175 Oct, 7.54429 Oct, 7.57588 Oct., 7 50231 Oct., 7 57697 Oct., 7.61969 Oct., 7 4636 Oct., 7 7338 Oct, 7.6227 Oct, 7 52450 Oct., 7.64462 Oct., 7 65418 Oct., 7.51721 Oct, 7.62039	144 5 54 144 14 22 144 11 8 144 11 7 144 32 54 144 7 0 144 12 58 145 46 144 22 144 16 144 11 32 144 15 32 144 15 53 144 11 8 144 11 29	175 0 43 175 2 25 175 3 18 175 6 33 175 11 13 175 4 47 175 3 55 175 42 175 13 40 175 3 175 3 40 175 4 41 175 6 4 175 2 24 175 3 59	40 37 33 40 42 38 40 46 32 40 48 49 41 1 6 40 40 48 40 46 7 41 28 40 42 30 40 50 40 47 56 40 49 33 40 46 42 40 48 29 40 45 50
89	1770 (1), Aug, 13 5385 Aug., 13.6885 Aug., 14 00281 Aug, 13 51950 Aug, 13.52180 Aug, 13.53477 Aug., 13 54034 Aug., 13 52680 Aug, 13 54085	356 16 26 356 19 40 356 26 13 356 15 11 356 16 38 356 15 58 356 16 51 356 16 27 356 16 51	132 0 0 132 20 0 132 17 3 131 54 54 131 52 46 132 31 38 131 58 56 131 59 34 131 58 56	1 33 40 1 34 30 1 34 30 1 34 31 1 33 50 1 33 4 1 34 28 1 34 31 1 34 28

Logarithm Per distance	Eccentricity.	Dir of Mot	Calculator	Authority.
0 004259	1.	D.	Struyck,	M A , 1763, 15.
0 003912	1.	D	Burckhardt,	A. J , 1810, 225
9 697597	1	D	Pingré,	M A., 1764, 487.
9 697895	1	D.	Pingré,	P, 11, 74, 106.
9.6974946	0 9954268	D.	Lexell,	Olb Abh (E)
9 6973706	1	D	Burckhardt,	M. C , x, 511.
9 6974784	0 998680	D.	Burckhardt,	M. C , x, 511
9 745621	1	R	Pingré,	M A , 1764, 344.
9 744462	1.	R	Pingré,	M A , 1771, 513.
9 703570	1	R	Pingré,	M. A , 1766, 424.
9 522112	1.	D.	Pingré,	P , 11, 106
9 6009521	0 864000	D.	Burckhardt,	Olb Abh (E)
9 09258	1	D.	Lalande,	M A., 1769, 55.
9 0898345	1	D.	Wallot,	M A , 1769, 56.
9 088420	1.	D.	Cassini, jr.,	M. A , 1769, 56.
9 088924	1	D.	Prosperin,	M A., 1775, 430
9 082785	1	D	Slop,	M A , 1775, 430.
9.09017	1	D.	Asclepi,	M. A , 1775, 430.
9 0890243	0 9987106	D.	Asclepi,	A J , 1810, 93
9 065953	1	D.	Lambert,	M. A., 1775, 430
9 089198	1.	D	Widder,	M A , 1775, 430.
9 088632		D.	Euler.	M A , 1775, 430
9 090847	1	D.	Legendre,	Olb Abh (E.)
9 0887919	0 9980036	D.	Lexell,	A J , 1810, 90
9 089002	0 998931555	D.	Pingré,	P., 11, 106.
9 0909110	1	D.	Pingré,	P. 11, 381
9 0890392	0 9992490099	D	Bessel,	A J , 1810, 123.
0 828906	0 7857651	D.	Lexell,	M. A., 1796, 639.
9 829600	0 7831996	D.	Lexell,	A J., 1781, 24
9.830520	0.7808638	D	Pingré,	P , 11, 89, 106.
9 828889	0.7854736	D	Burckhardt,	M. C., xvi, 508.
9 828853	0.78554	D	Burckhardt,	Olb Abh. (E)
9 8290030	0 7862730	D.	Clausen,	A N , xix, 165
9.8289484	0 7861193	D	Clausen,	A. N , xix, 165
9 8288596	0 786839	D	Leverrier,	C R , xix, 559.
9.8289491	0 786119	D.	Leverrier,	C. R , xxvi, 468.

No.	Perihelion Passage. Greenwich Mean Time.	Longitude of Perihelion	Longitude of Node.	Inclination
90	1770 (2), Nov, 22.2352	208 22 44	108 42 10	31 25 55
91	1771, April, 18 92020	103 28 13	27 51 0	11 15 29
	April, 19.02096	103 48 21	27 49 37	11 16 44
	April, 19.20926	104 2 54	27 50 27	11 16 0
	April, 19 09795	103 57 46	27 56 10	11 15 28
	April, 19 21271	104 3 10	27 51 49	11 15 19
92	1772, Feb, 18.86196	108 6 22	252 43 5	18 59 40
	Feb., 23.4435	115 6 25	251 11 56	18 21 24
	Feb, 20 12090	110 6 0	252 25 54	18 51 6
	Feb, 19.09933	110 14 54	254 0 1	18 17 38
	Feb, 9.202	90 17	261 9	20 28
	Feb., 8.035	97 21	263 24	17 39
93	1773, Sept, 2 4935	81 40	123 15	62 33
	Sept, 2 7852	80 43	123 35	62 36
	Sept, 5.2058	75 9 17	121 10 26	61 19 7
	Sept., 5 2414	75 15 50	121 12 11	61 20 57
	Sept, 5.4726	75 28 17	121 13 4	61 18 22
	Sept, 5 5846	75 17 0	121 8 20	61 15 11
	Sept, 5.70811	76 10 26	121 20 0	61 30 0
	Sept., 5.46485	75 35 43	121 15 37	61 25 21
	Sept., 5 37685	74 57 41	121 4 49	61 13 19
94	Sept., 5.60680	75 10 58	121 5 30	61 14 17
	1774, Aug., 14.1741	316 27 57	180 57 26	82 47 40
	Aug., 14 7407	316 48 24	180 50 13	82 48 38
	Aug., 15 2136	317 26	181 22	82 21
	Aug, 15 44877	317 22 4	180 49 48	83 0 25
	Aug., 17 5352	313 19	183 32	83 30
	Aug, 14 4935	316 38	180 54	82 48
95	Aug., 15 83010	317 27 40	180 44 34	83 20 6
	1779, Jan., 4.09767	87 14 0	25 3 1	32 26 14
	Jan., 4 09385	87 13 40	25 3 57	32 25 30
	Jan., 4 08517	87 13 11	25 5 51	32 24 0
	Jan., 4 11456	87 12 55	25 4 19	32 24 44
	Jan., 4 0970	87 16	25 5	32 24
	Jan., 3.75635	86 52 29	25 2 55	32 41 32
	Jan., 4 09699	87 14 19	25 7 9	32 18 24
	Jan., 4.17502	87 18 44	25 8 23	32 16 56

Logarithm Per Distance	Eccentricity.	Dir of Met	Calculator.	Authority
22833	1.	R.	Pingré,	P., ii, 106.
257013	1.	D.	Pingré,	M. A., 1777, 175.
255148	1.	D.	Prosperin,	A. J., 1781, 24
2558644	1.00944	D.	Burckhardt,	M. C., x, 512.
2552324	1.	D.	Eneke,	Z. C., v, 560.
2559104	1.0093698	D.	Encke,	Z. C., v, 559
207812	1.	D.	Lalande,	L., iii, 257.
219382	1.	D.	Burckhardt,	Olb Abh. (E.)
2120418	1.	D.	Bessel,	M. C., xiv, 73
2058652	0.9031481	D.	Bessel,	M. C., xiv, 74.
25027	1.	D.	Gauss,	M. C., xiv, 84.
25990	0.67692	D.	Gauss,	M. C., xiv, 84.
292721	1.	D.	Lambert,	A. J., 1777, 136.
284755	1.	D.	Schulze,	A. J., 1777, 137.
2526066	0.9930757	D.	Lexell,	A. J., 1783, 74
2531150	0.9951225	D.	Lexell,	A. J., 1783, 74
2535141	1.0037085	D.	Lexell,	A. J., 1783, 75.
2524203	1.0024901	D.	Lexell,	A. J., 1783, 75.
256965	1.	D.	Pingré,	M. A., 1774, 327.
254576	1	D.	Pingré,	M. A., 1774, 327.
251272	0.993502334	D.	Pingré,	P., ii, 93, 108.
251880	1.	D.	Burckhardt,	M. C., x, 512.
153900	1.	D.	Saron,	M. A., 1775, 473.
153900	1.	D.	Saron,	M. A., 1775, 473.
154121	1.	D.	Boscovich,	M. A., 1775, 473.
154906	1.	D.	Méchain,	M. A., 1775, 473.
16346	1	D.	Bode,	A. J., 1779, 87.
153815	1.	D.	Du Séjour,	A. J., 1779, 88.
1562066	1.0282955	D.	Burckhardt,	Olb Abh. (E.)
853222	1.	D.	Saron,	M. A., 1779, 353.
853203	1.	D.	D'Angos,	A. J., 1784, 160.
853167	1.	D.	Méchain,	M. A., 1779, 353.
853057	1.	D.	Reggio,	M. A., 1779, 353.
853516	1.	D.	Oriani,	Olb. Abh. (E.)
851811	1	D.	Oriani,	Olb. Abh. (E.)
853220	1.	D.	Prosperin,	A. J., 1789, 167.
853469	1.00001	D.	Prosperin,	Olb Abh. (E.)

No	Perihelion Passage Greenwich Mean Time	Longitude of Perihelion.	Longitude of Node	Inclination.
95	1779, Jan., 4 08634 Jan, 6 6711 Jan, 4 10445 Jan., 4 10507	0' " 87 14 27 86 55 86 53 87 9 40	0' " 25 4 10 16 51 23 40 24 57 18	0' " 32 30 57 45 20 32 43 32 31 7
96	1780 (1), Sept, 30 83820 Sept, 30.66600 Sept, 30.75241 Sept, 30 92630	246 30 14 246 19 21 246 21 18 246 35 56	124 0 0 124 30 0 124 9 19 123 41 15	53 56 28 53 15 20 53 48 15 54 23 12
97	1780 (2), Nov, 28.8479	246 52	141 1	72 3 30
98	1781 (1), July, 7.18887	239 11 25	83 0 38	81 43 26
99	1781 (2), Nov, 29 52251 Nov, 29.52320 Nov, 29 52320	16 3 28 16 3 7 16 3 7	77 22 52 77 22 55 77 22 55	27 13 8 27 12 4 27 12 4
100	1783, Nov, 15 23891 Nov, 13 2525 Nov., 20 3866 Nov., 19 50114 Nov., 19.56218	45 24 46 43 58 47 49 4 30 50 3 8 49 31 55	54 13 50 54 10 10 54 10 45 55 45 20 55 12 0	53 9 9 54 9 53 52 19 57 44 53 24 47 43 0
101	1784, Jan., 21 19960	80 44 24	56 49 21	51 9 12
?	1784, April, 9 88014 March, 11 3 March, 9 29 March, 10 0	328 54 57 150 135 137	86 52 9 55 42 35	47 55 10 26 64 84
102	1785 (1), Jan, 27 32549	109 51 56	264 12 15	70 14 12
103	1785 (2), April, 8 3742 April, 8.4720	297 29 33 297 34 30	64 33 36 64 44 40	87 31 54 87 7 0
104	1786 (1), Jan. 30 8735	156 38	334 8	13 36
105	1786 (2), July, 7.91032 July, 8 56747	159 25 36 158 38 30	194 22 40 195 23 32	50 54 28 50 58 33
106	1787, May, 10 82545	7 44 9	106 51 35	48 15 51
107	1788 (1), Nov., 10.3095 Nov, 10 30932	99 8 27 99 8 7	157 10 38 156 56 43	12 28 20 12 27 40
108	1788 (2), Nov., 20.37805 Nov., 20.30254	23 12 22 22 49 54	351 42 15 352 24 26	64 52 32 64 30 24

Logarithm For distance	Eccentricity	Dir. of Mot	Calculator	Authority
9 853186	I	D	Zach,	Olb Abh. (E)
9.85065	I.	D	Bode,	A. J., 1782, 15.
9.85309	I.	D	Olbers,	A. J., 1782, 131
9 853160	I.	D.	Pacassi,	Olb. Abh (E)
8 9903713	I.	R	Lexell,	M. A., 1780, 532
9.0020265	I.	R	Lexell,	M. A., 1780, 532.
8 996755	I.	R.	Méchain,	A. J., 1784, 141
8 9836418	9 9999460	R.	Cluver,	A. N., vi, 147
9 712041	I.	R.	Olbers,	A. J., 1804, 179
9 889784	I.	D	Méchain,	A. J., 1785, 166.
9.982729	I.	R	Méchain,	M. A., 1781, 166.
9 982721	I.	R	Méchain,	A. J., 1786, 231.
9 982723	I.	R	Legendre,	Olb Abh (E.)
0.194606	I	D.	Méchain,	M. A., 1783, 648.
0.195175	I.	D	} Méchain and { Saron,	M. A., 1783, 132.
0.197881	I.	D.		M. A., 1783, 132.
0 1626829	0.5395343	D.	Burckhardt,	Olb Abh (E)
0 1747341	0.6784	D	Burckhardt,	Olb Abh (E)
9 849946	I.	R.	Méchain,	M. A., 1784, 363.
9 8132683	I	R	D'Angos,	M. A., 1784, 327.
9.83385	I.	D.	Burckhardt,	M. C., xvi, 513
9 76768	I.	D.	Burckhardt,	M. C., xvi, 514.
9.80462	I.	D	Burckhardt,	M. C., xvi, 514.
0 058198	I.	D.	Méchain,	A. J., 1788, 166.
9.630733	I.	R	Méchain,	L., iii, 257.
9 631024	I.	R	Saron,	M. A., 1785, 652.
9 52481	0 84836	D	Encke,	A. J., 1822, 196.
9.612889	I.	D	Méchain,	A. J., 1790, 181.
9 595763	I.	D	Reggio,	Olb. Abh (E)
9 542714	I.	R	Saron,	A. J., 1791, 155.
0 026538	I.	R	Méchain,	Olb. Abh (E.)
0 026538	I.	R	Méchain,	A. J., 1793, 118.
9 885988	I.	D	Méchain,	Olb. Abh. (E)
9 879276	I	D	Méchain,	M. A., 1789, 684.

No.	Perihelion Passage Greenwich Mean Time	Longitude of Perihelion	Longitude of Node	Inclination.
109	1790 (1), Jan., 15.2123 Jan, 16.79038	60 14 32 58 24 45	176 11 46 172 50 2	31 54 15 29 44 7
110	1790 (2), Jan, 28.31677	111 44 37	267 8 37	56 58 13
111	1790 (3), May, 21.24090 May, 20 4727	273 43 27 274 57 20	33 11 2 35 14	63 52 27 63 35
112	1792 (1), Jan, 13 56590 Jan, 13.53489 Jan., 14. Jan., 15 24975	36 29 42 36 20 32 34 56 34 43	190 46 15 190 42 9 191 28 191 55	39 46 55 39 45 47 41 38 41 5
113	1792 (2), Dec, 27.1984 Dec., 27 32440 Dec, 27.25360	136 5 33 135 52 35 135 59 24	283 17 36 283 14 44 283 15 17	49 0 24 49 7 13 49 1 45
114	1793 (1), Nov, 4 8414	228 42	108 29	60 21
115	1793 (2), Nov., 18 6449 Nov, 18.7289 Nov, 28 59981	71 0 71 4 51 75 58 58	2 20 2 23 55 359 4 48	51 56 51 56 46 47 35 5
(104)	1795, Dec, 15.40491 Dec, 15 36991 Dec., 15 38793 Dec., 21.44098	160 21 47 159 53 26 160 20 53 156 41 24	351 15 56 351 58 47 351 47 21 334 39 26	21 45 11 21 56 2 21 45 52 13 42 30
116	1796, April, 2.82478	192 44 13	17 2 16	64 54 33
117	1797, July, 10 3795 July, 9 10497 July, 9.11424	56 7 49 27 8 49 34 42	331 40 329 15 37 329 16 30	43 12 50 40 34 50 35 50
118	1798 (1), April, 4 48079 April, 4 49879	104 59 0 105 6 57	122 9 0 122 12 21	43 52 16 43 44 42
119	1798 (2), Dec, 31 91381 Dec, 31.54090 Dec, 31.55350	33 35 5 34 29 48 34 27 27	249 30 2 249 30 44 249 30 30	42 14 52 42 23 25 42 26 4
120	1799 (1), Sept., 7 27601 Sept., 7 23562 Sept., 7 18401 Sept., 7.20635 Sept., 7 23199	3 40 25 3 39 46 3 36 4 3 41 15 3 39 10	99 15 21 99 32 47 99 33 38 99 30 37 99 27 19	51 10 7 50 56 27 50 52 27 50 57 6 50 57 30

Logarithm Per distance	Eccentricity.	Dir of Mot	Calculator.	Authority
9 879725	I.	R.	Saron,	A. J., 1794, 94.
9 873516	I.	R.	Saron,	M. A., 1790, 312.
0.0266503	I.	D.	Méchain,	M. A., 1790, 317.
9 9019814	I.	R.	Méchain,	M. A., 1790, 336.
9.898179	I	R.	Englefield,	Olb. Abh. (E.)
0 1116064	I.	R.	Méchain,	A J., 1797, 122.
0.1114563	I.	R.	Zach,	A. J , 1796, 148.
0.1166	I.	R.	Bode,	D., in, 413
0 111195	I.	R	Englefield,	Olb. Abh (E.)
9 984893	I.	R	Méchain,	A. J , 1797, 136.
9.985350	I	R	Piazzi,	Olb. Abh. (E)
9.985106	I.	R.	Prosperin,	A. J , 1799, 192.
9.605736	I.	R.	Saron,	A. J., 1798, 243.
0 177392	I.	D	Saron,	A. J., 1798, 243.
0 177388	I.	D.	Saron,	Olb. Abh (E)
0 1461360	0 7347635	D.	Burckhardt,	Olb. Abh. (E.)
9.389538	I.	D.	Olbers,	A J., 1814, 72.
9.387408	I	D.	Olbers,	A. J , 1814, 72.
9.3883480	I	D.	Encke,	A. J., 1822, 184.
9 5243046	0.8488828	D.	Encke,	A. J., 1822, 186.
0.198151	I.	R.	Olbers,	A. J., 1799, 106
9.66558	I.	R.	Bode,	A J., 1801, 101.
9.721489	I.	R.	Olbers,	A. J., 1801, 167.
9 720531	I.	R	Bouvard,	G. E., 1, 128.
9 685525	I.	D	Burckhardt,	Olb. Abh. (E)
9.685371	I.	D	Olbers,	Olb. Abh. (E.)
9 889186	I.	R.	Olbers,	A. J., 1802, 199.
9.891917	I.	R.	Burckhardt,	G. E., iii, 398.
9.891829	I	R.	Burckhardt,	G. E., iii, 398.
9 925031	I.	R	Burckhardt,	G E., iv, 262.
9 924250	I.	R	Burckhardt,	G E., iv, 443.
9.923596	I.	R.	Méchain,	G. E , iv, 262.
9 924281	I.	R.	Méchain,	M C., ii, 81.
9.924372	I.	R.	Zach,	G. E., iv, 367.

No.	Perihelion Passage Greenwich Mean Time	Longitude of Perihelion	Longitude of Node	Inclination
120	1799 (1), Sept., 7.22626 Sept., 7.24347	0 ' " 3 38 9 3 38 16	0 ' " 99 21 11 99 23 3	0 ' " 51 1 29 51 2 27
121	1799 (2), Dec , 25.78783 Dec., 25.75261 Dec., 25.89640	190 14 52 190 22 46 190 20 12	326 27 18 326 30 18 326 49 11	77 0 47 77 5 4 77 1 38
122	1801, Aug , 8.54 Aug., 8 5574	181 1 183 49	42 8 44 28	20 20 21 20
123	1802, Sept , 9 85686 Sept., 9 89102	332 7 45 332 9 4	310 16 46 310 15 39	57 0 20 57 0 47
124	1804, Feb., 13 58813 Feb., 13 64628 Feb , 13 59472	148 44 51 148 53 32 149 4 25	176 47 58 176 49 47 176 53 29	56 28 40 56 44 20 56 56 2
(104)	1805 (1), Nov , 18 13132 Nov., 17 716 Nov., 18 01086 Nov., 18 04079 Nov., 21 49987	147 51 28 157 17 149 0 28 148 44 57 156 47 19	344 37 19 340 11 345 6 51 345 5 58 334 20 5	15 36 36 17 34 15 58 12 15 52 38 13 33 30
(92)	1805 (2), Dec , 31.27619 Dec., 31 25701 Dec , 31 7710 Dec., 31 27901 Dec., 31 25808 Dec., 33.43459 Dec , 31.35551 Dec., 31 23428 Dec , 32 9742	109 23 40 109 21 55 109 23 13 109 23 39 109 21 50 109 30 2 109 28 54 109 23 29 109 32 23	250 33 14 250 34 42 250 48 5 250 33 34 250 33 35 251 28 23 250 31 34 250 33 20 251 15 15	16 33 33 16 30 35 15 36 10 16 31 10 16 30 32 12 43 10 16 35 9 16 31 27 13 38 45
125	1806, Dec , 28 91180 Dec , 28.93150 Dec., 28.8268	94 4 30 97 2 3 96 57	322 18 38 322 19 15 322 13	35 4 5 35 2 50 35 6
126	1807, Sept , 18 78249 Sept , 18 78934 Sept., 18.8192 Sept., 18.81327 Sept., 18.75451 Sept., 18 72811 Sept., 18 48315	270 56 53 271 0 13 270 53 38 271 6 8 270 51 35 270 45 1 270 5 55	266 39 40 266 38 31 266 29 25 266 40 52 266 42 12 266 39 9 266 40 26	63 14 1 63 12 36 63 16 15 63 13 17 63 12 51 63 12 30 63 27 14

Logarithm Per distance	Eccentricity	Dir of Mot.	Calculator.	Authority.
9.924471	1.	R.	Olbers,	A J., 1803, 102.
9 924437	1.	R.	Wahl,	G. E , iv, 453.
9 795496	1.	R.	Olbers,	M C , 1, 299.
9 7954827	1.	R.	Wahl,	M. C , i, 300.
9 796437	1.	R.	Méchain,	M C., ii, 81
9.3962	1.	R.	Méchain,	A J , 1805, 130.
9.417804	1.	R.	Burckhardt,	A J , 1809, 272.
0 0390985	1.	D.	Méchain,	M C., vi, 585.
0 039061	1.	D.	Olbers,	M. C., vi, 507.
0 029858	1.	D.	Gauss,	A J., 1807, 232.
0 030308	1.	D.	Bouvard,	Olb Abh (E.)
0 031412	1.	D.	Wahl,	A. J., 1807, 232.
9 5782015	1.	D.	Bessel,	A. J., 1809, 135.
9.53969	1.	D.	Gauss,	M. C , xiii, 83.
9 574798	1.	D.	Legendre,	M C., xiv, 70.
9.575461	1.	D.	Bouvard,	Olb. Abh. (E)
9 5320168	0.84617529	D	Encke,	Z. C., ii, 316.
9 9502477	1.	D.	Gauss,	M C., xiii, 89.
9 950379	1.	D.	Bessel,	M. C , xiii, 91.
9 9527025	0.9143069	D.	Bessel,	M C., xiv, 74.
9 950270	1.	D.	Legendre,	M. C., xiv, 72.
9.950330	1.	D.	Gauss,	M. C., xiv, 77.
9 9598931	0.6769242	D.	Gauss,	M. C., xiv, 79.
9.950047	1.	D	Bouvard,	M C., xxvi, 484.
9 9502662	1.	D	Bouvard,	Olb. Abh. (E)
9 9575120	0.745784	D	Gambart,	A. N., v, 126
0 034198	1.	R.	Bessel,	M C , xvi, 181.
0 034055	1.	R.	Burckhardt,	Olb. Abh (E)
0 03342	1.	R	Burckhardt,	A J., 1810, 224.
9.8112331	1.	D	Bouvard,	M. C. xvi, 562.
9.8114927	1.	D	Gauss,	M C , xvi, 565, xvii, 183.
9.811316	1.	D	Brojelmann,	M C , xix, 201.
9 8118803	1.	D.	Orani,	M C , xviii, 243.
9 810412	1.	D	Ferrer,	A. J , 1813, 247.
9 810376	1.	D.	Lemeur,	A. J , 1813, 247
9 810375	1.	D.	Triesnecker,	A J., 1811, 126.

No	Perihelion Passage Greenwich Mean Time.	Longitude of Perihelion	Longitude of Node	Inclination
126	1807, Sept, 18.65522 Sept., 18.80436 Sept., 18 86540 Sept, 18 78723 Sept, 18.91434 Sept., 18.78259 Sept, 18 82068 Sept., 18 74336 Sept., 18 73059 Sept., 18.73887	0 ' " 270 39 22 270 59 55 271 6 53 270 58 21 271 19 9 270 58 5 271 6 8 270 56 0 270 53 51 270 54 42	0 ' " 266 36 57 266 25 3 266 33 4 266 40 46 266 22 29 266 40 31 266 36 52 266 46 3 266 48 9 266 47 11	0 ' " 63 17 58 63 9 57 63 11 18 63 13 2 63 7 1 63 13 2 63 14 28 63 10 53 63 10 11 63 10 28
127	1808 (1), May, 12 953	69 12 57	322 58 36	45 43 7
128	1808 (2), July, 12.16768	252 38 50	24 11 15	39 18 59
129	1810, Oct., 5.82280 Sept., 29.0997	63 9 10 52 44 42	308 53 4 310 21 2	62 46 17 61 11 15
130	1811 (1), Sept, 12.40628 Sept., 12 19547 Sept., 12.13111 Sept., 10.00804 Sept, 12 28343 Sept, 12 40628 Sept, 12 24525 Sept., 12 31310 Sept., 12.24362 Sept., 12 38172 Sept., 12 35095 Sept., 12 20347 Sept, 12.25731 Sept, 12.24444 Sept., 12 35260 Sept, 12 35325 Sept, 12 40183 Sept, 12 16720 Sept, 12.27322 Sept., 12.26318	74 48 14 75 17 34 73 40 45 73 14 35 74 29 40 74 48 14 75 1 9 74 56 0 75 1 44 74 51 58 74 54 24 75 4 43 75 0 34 75 0 0 74 55 6 75 5 35 74 12 75 7 49 75 0 19 75 0 25	140 20 25 140 24 13 140 10 13 141 4 59 140 16 56 140 20 25 140 24 30 140 19 50 140 21 58 140 23 18 140 23 46 140 21 40 140 24 44 140 24 26 140 24 41 140 37 2 140 13 140 25 46 140 24 56 140 24 33	73 9 40 73 7 16 72 59 55 73 48 2 72 59 10 73 9 40 73 2 36 73 3 3 73 4 31 73 3 44 73 3 23 73 4 18 73 2 21 73 2 43 73 4 48 73 10 33 72 48 73 5 11 73 2 31 73 1 51
131	1811 (2), Nov, 9 23849 Nov., 11 19212 Nov, 11.54158	46 10 50 47 32 10 47 47 0	92 57 1 92 53 9 92 55 1	31 29 28 31 32 53 31 31 52

Logarithm Per distance.	Eccentricity	Dir of Mot	Calculator.	Authority.
9.811657	1.	D.	Santini,	A. J , 1811, 127.
9.812659	1.	D	Bowditch,	A J., 1814, 149.
9 812090	1.	D.	Damoiseau,	Olb. Abh (E)
9.8112156	1.	D.	Cacciatore,	A. J., 1815, 124
9 8135761	1.	D	Bessel,	M C., xvi, 564.
9 8112133	1.	D.	Bessel,	M C., xvii, 82.
9.8122168	1.	D	Bessel,	A. J., 1811, 156.
9.8105558	0.9958626	D	Bessel,	A. J , 1811, 157.
9 8101466	0 99503415	D	Bessel,	A. J., 1811, 158
9.81031575	0.99548781	D.	Bessel,	A. J , 1813, 188.
9.59091	1.	R.	Encke,	A. N., v, 7.
9.783870	1.	R.	Bessel,	M. C., xviii, 359.
9 986385	1.	D	Bessel,	A J., 1814, 179.
9.9893549	1.	D	Triesnecker,	A. J., 1815, 128.
0 015225	1.	R	Bessel,	A. J., 1814, 258.
0.017060	1.	R.	Gauss,	A J., 1814, 255.
0.004514	1.	R	Olbers,	M. C., xxvi, 486
9.99153	1.	R	Gauss,	M C , xxiv, 180.
0 011638	0.9919529	R	Flaugergues,	M C , xxiv, 509.
0 015225	1.	R	Bessel,	A. J., 1814, 258.
0 0151120	0 9954056	R	Bessel,	A. J , 1815, 114.
0.0152885	1.	R.	Bouvard,	M. C , xxv, 380.
0 0151048	1.	R	Nicolai,	M. C., xxiv, 592.
0 0154347	1.	R.	Piazzi,	M. C , xxvii, 359
0.0154432	1.	R.	Conti,	Olb Abh. (E.)
0.0155530	1.	R	Gauss,	M. C , xxiv, 409
0.0151178	0.99509330	R	Argelander,	A. J., 1825, 250.
0 0151869	0 9950827	R.	Conti,	M. C , xxviii, 31.
0 0154327	1.	R	Ornani,	Olb. and Santini.
0 0155122	1.	R	Triesnecker,	A J , 1815, 132
0 0096251	1.	R.	Burckhardt,	M C , xxiv, 414.
0.0149953	1.	R	Bowditch,	Olb. Abh. (E.)
0.0151448	0.9960455	R	Lemour,	Olb. Abh. (E)
0.0151269	0 99571555	R	Ferrer,	Olb Abh. (E)
0 2001197	1.	D.	Werner,	M C., xxv, 91.
0.2011007	1.	D.	Werner,	M C , xxv, 198.
0 2012968	1.	D	Werner,	M. C , xxv, 198.

No.	Perihelion Passage Greenwich Mean Time	Longitude of Perihelion.	Longitude of Node	Inclination.
		° ' "	° ' "	° ' "
131	1811 (2), Nov , 11 10818	47 29 20	92 56 13	31 29 14
	Nov , 11 18106	47 31 53	92 54 26	31 30 57
	Nov., 10 99048	47 27 20	93 1 45	31 17 11
	Nov., 12.76308	48 42 26	92 57 51	31 31 30
132	1812, Sept , 14 85179	91 54 45	253 43 25	73 53 51
	Sept., 15 20996	92 40 29	253 36 25	74 1 32
	Sept , 14 99350	92 54 38	253 18 50	74 20 30
	Sept., 15 15547	92 39 46	253 40 47	73 57 0
	Sept , 15.44682	93 9 41	253 37 21	73 57 53
	Sept , 15 15380	92 39 53	253 40 46	73 57 3
	Sept., 15 31356	92 18 46	253 1 3	73 57 3
	Sept , 16.27114	95 3 4	253 53 14	75 7 15
133	1813 (1), March, 4.58199	69 52 14	60 22 0	20 58 14
	March, 4 52475	69 57 29	60 35 54	21 9 49
	March, 4 52650	69 56 8	60 48 24	21 13 33
134	1813 (2), May, 19 71210	197 59 0	42 41 49	81 23 31
	May, 19 50916	197 37 6	42 40 21	81 1 0
	May, 19 29690	197 53 36	42 40 6	81 1 30
	May, 19 41896	197 43 46	42 40 40	81 2 28
	May, 19 41745	197 43 8	42 40 15	81 2 12
	May, 19.62378	197 28 37	42 39 36	80 55 5
	May, 19 58718	197 31 19	42 39 55	80 57 29
	May, 19 51070	197 36 49	42 40 12	81 7 28
135	1815, April, 25 10617	147 3 54	82 45 37	44 52 10
	April, 24 8417	146 37 38	82 49 22	45 0 47
	April, 25 45940	147 35 55	82 43 6	44 43 13
	April, 25 15749	147 4 42	82 47 54	44 52 40
	April, 25 98725	148 58 48	83 26 21	44 30 43
	April, 26 04207	149 2 58	83 26 50	44 30 45
	April, 26 00875	149 3 25	83 28 52	44 29 46
	April, 25 99312	149 1 58	83 28 36	44 29 52
	April, 25 99714	149 2 45	83 29 2	44 29 54
	April, 25 99217	149 2 12	83 28 50	44 29 55
(92)°	1818 (1), Feb , 7-397	95 7 0	250 4 0	20 2 24
136	1818 (2), Feb , 27.4012	183 57	70 7	89 42
	Feb , 26.24350	182 56 52	70 21 10	89 47 27

Logarithm Per distance	Eccentricity	Dir of Mot	Calculator	Authority
0 2008271	I.	D.	Werner,	M C., xxv, 292.
0 2009477	I.	D.	Nicolai,	M C , xxvii, 207
0 1992359	0 98271088	D	Nicolai,	M. C xxviii, 215.
0 2033993	I.	D.	Oriani,	M. C , xxvi, 531
9.8966909	I.	D.	Werner,	M. C., xxvi, 409
9.8932745	I.	D.	Werner,	M C , xxvi, 583
9.8911749	I.	D.	Nicollet,	M C., xxvi, 486.
9 8933046	I	D	Nicollet,	Olb Abh (E)
9 8929724	I	D.	Triesnecker,	A. J., 1816, 155.
9 8932995	I	D	Bouvard,	A. J., 1816, 238
9 8904995	0 9545412	D	Encke,	Olb Abh. (E)
9 8928365	I	D.	Oriani,	Olb Abh. (E.)
9 8441175	I	R.	Werner,	M. C , xxvii, 285
9.8445998	I.	R	Werner,	M C., xxvii, 570.
9 8445579	I.	R.	Nicollet,	Olb Abh (E.)
0 0854348	I.	R.	Daussy,	Olb Abh (E)
0 0846906	I.	R.	Daussy,	M. C , xxviii, 100.
0.0855046	I.	R	Nicollet,	Olb Abh (E)
0.084969	I.	R.	Encke,	M C , xxviii, 99.
0 0849212	I	R.	Gerling,	M C , xxviii, 502.
0 084364	I.	R	Olbers,	A. J., 1817, 99
0 0844702	I.	R.	Werner,	M. C , xxvii, 491.
0 0846799	I.	R.	Ferrer,	Olb. Abh. (E.)
0.092156	I.	D.	Bessel,	A J , 1818, 207.
0 0937771	I.	D.	Triesnecker,	A. J., 1818, 218.
0 0899899	I.	D	Gauss,	A J , 1818, 231
0 0924294	I.	D.	v. Lindenau,	A J , 1818, 246
0.0840362	0 933149	D	Gauss,	A J , 1818, 232.
0 0838930	0 9305435	D	Nicollet,	Olb. Abh (E)
0 0837490	0 93029345	D	Nicolai,	A. J., 1818, 265
0 0838369	0 9316693	D	Nicolai,	Olb Abh (E.)
0 0837950	0 93112771	D	Bessel,	A. J , 1818, 209
0.0838109	0 93121968	D.	Bessel,	Olb. Abh (E)
9.86526	I.	D.	Pogson,	A. S N., x, 135
0 0178185	I	D.	Olbers,	A. J., 1821, 161
0 0787394	I	D.	Nicollet,	Olb Abh (E.)

No	Perihelion Passage. Greenwich Mean Time.	Longitude of Perihelion	Longitude of Node	Inclination
136	1818 (2), Feb., 26.87146 Feb, 25.95890	183 22 58 182 45 22	70 5 12 70 26 11	90 0 0 89 43 48
137	1818 (3), Dec., 4 99350 Dec., 4 09029 Dec, 4.93468 Dec, 5.03252	101 46 58 103 7 5 101 55 2 101 47 30	89 55 14 90 7 29 89 59 53 90 0 51	63 10 30 62 40 50 63 5 29 63 0 24
(104)	1819 (1), Jan., 24 90178 Jan., 24.96498 Jan., 24.95739 Jan, 27.10435 Jan, 27.24563 Jan., 27.25616	144 23 52 146 46 6 144 52 12 156 14 12 157 5 57 156 59 12	329 22 47 331 21 13 329 4 36 334 18 12 334 43 41 334 33 19	14 40 37 15 11 43 14 47 42 13 42 30 13 38 42 13 36 54
138	1819 (2), June, 27.71484 June, 27 73146 June, 27.71522 June, 27 76636 June, 27 73998 June, 27 71600 June, 27.70287	287 6 25 287 13 45 287 2 38 287 24 18 287 13 4 287 5 54 287 5 5	273 42 9 273 43 57 273 43 33 273 42 52 273 42 28 273 42 52 273 43 44	80 45 12 80 44 16 80 45 26 80 42 22 80 43 56 80 44 44 80 45 53
139	1819 (3), July, 20.67406 July, 19 21990 July, 31.13915 July, 18 90020	272 34 56 270 9 31 290 40 12 274 40 54	109 56 47 110 3 34 114 31 21 113 10 48	11 53 13 11 46 9 11 16 55 10 42 48
140	1819 (4), Nov, 16 87645 Nov, 21 04059 Nov., 20.24553	69 32 53 71 23 38 67 18 42	83 34 3 80 57 23 77 13 51	11 44 17 10 56 13 9 1 16
141	1821, March, 21.51558 March, 21 65220 March, 21.58697 March, 21.57807 March, 21.39150 March, 21 59128 March, 21 30125 March, 21 46653 March, 21.53656	239 28 21 239 40 27 239 35 53 239 34 5 239 18 37 239 34 12 240 35 8 239 30 30 239 29 25	48 38 48 48 46 30 48 44 18 48 43 34 48 32 12 48 44 21 49 38 17 48 42 18 48 40 56	73 39 40 73 8 53 73 20 0 73 23 15 74 10 53 73 19 44 74 32 41 73 34 53 73 33 7
142	1822 (1), May, 5 24445	192 44 9	176 26 9	53 41 0

Logarithm Per distance	Eccentricity.	Dir of Mot	Calculator	Authority.
0 07937	I.	D	Gauss,	Olb. Abh. (E)
0 0783711	I.	D	Encke,	A. J, 1821, 162.
9 9326919	I.	R.	Nicollet, *	Olb. Abh (E)
9.928324	I.	R.	Bessel,	A J., 1822, 172.
9 9320148	I.	R.	Rosenberg and	A. J., 1824, 144.
9.9319574	I.011617	R	Schercke,	A J, 1824, 145.
9 54790	I.	D	Encke,	Z C., ii, 189
9 51802	I	D	Encke,	Z C, ii, 189.
9 5472367	I.	D	Nicollet,	Olb. Abh (E)
9 5257869	0 8567776	D	Encke,	Z C, ii, 307.
9 5237230	0 8490883	D	Encke,	A. J, 1822, 194.
9 5253771	0.8485841	D	Encke,	Olb. Abh (E)
9 5330800	I.	D	Durksen,	A. J, 1822, 236.
9.5339701	I	D.	Cacciatore,	A J, 1823, 124.
9 5331982	I.	D	Smadecki,	A J., 1823, 121.
9 53528	I.	D.	Encke,	A. J., 1822, 203.
9.5340268	I.	D.	Nicolai,	A J., 1822, 224
9.5327646	I.	D	Bouvard,	Olb. Abh (E)
9.5328194	I.	D.	Brinkley,	Trans R.I.A., xiii, 197
9 87076	I.	D	Carlını,	Z. C, iii, 197
9 88244	I	D.	Encke,	A J, 1822, 243.
9.84515	0.60353	D	Encke,	Z. C, iii, 198.
9.8885382	0 75519035	D	Encke,	Z C, iii, 293
9.93824	I.	D.	Carlını,	Z C, iv, 519.
9 94388	I.	D.	Encke,	Z C, iv, 519.
9 9506368	0 6867458	D	Encke,	A. J., 1824, 220.
8 96288	I	R	Encke,	A. J, 1824, 221.
8 967118	I	R.	Bessel,	A J, 1824, 242.
8 9651463	I	R	Rümker,	A. J, 1824, 174.
8.96466	I.	R.	Nicolai,	A. J., 1824, 169
8 95958	I.	R.	Nicollet,	Olb. Abh. (E.)
8 9645990	I	R	v. Staudt,	A J., 1825, 105.
8 95134	I.	R	Brinkley,	A. J, 1825, 254
8 9622604	I	R.	Brinkley,	Z C, xi, 200
8.9629523	I.	R	Rosenberger,	Z C, vi, 479
9 70212	I	R	Carlını,	Z C., vi, 479.

No.	Perihelion Passage Greenwich Mean Time	Longitude of Perihelion.	Longitude of Node	Inclination
142	1822 (1), May, 5.31930	0° 43' 16"	0° 35' 58"	53° 36' 7"
	May, 5.23810	192 42 30	176 38 54	53 33 0
	May, 5.62210	192 48 45	177 30 50	53 34 3
	May, 5.60600	192 43 51	177 26 56	53 37 24
	May, 5.56678	192 45 33	177 22 25	53 36 12
	May, 5.56587	192 47 44	177 25 2	53 35 34
	May, 5.26587	193 2 20	176 38 4	53 48 36
	May, 5.57938	192 45 48	177 27 22	53 34 48
(104)	1822 (2), May, 23.98786	157 11 29	334 19 32	13 22 25
	May, 23.96296	157 11 44	334 25 9	13 20 17
143	1822 (3), July, 16.53135	218 32 56	97 40 3	38 12 39
	July, 16.02433	219 53 48	97 51 23	37 43 4
144	1822 (4), Oct., 23.24731	272 19 40	92 28 2	52 32 52
	Oct., 23.33950	272 10 55	92 25 7	52 30 55
	Oct., 23.56758	273 11 27	92 33 4	52 36 22
	Oct., 23.62882	271 48 7	92 42 39	52 39 18
	Oct., 23.63428	271 47 52	92 43 58	52 39 48
	Oct., 23.62949	271 48 9	92 42 47	52 39 6
	Oct., 23.29936	272 13 2	92 26 2	52 30 15
	Oct., 23.54963	271 53 40	92 38 25	52 36 52
	Oct., 23.62637	271 48 16	92 42 36	52 39 11
	Oct., 23.5716	271 53 46	92 42 10	52 39 52
	Oct., 24.96392	270 31 41	93 5 3	52 39 42
	Oct., 23.95472	271 29 56	92 47 31	52 39 7
	Oct., 23.62805	271 48 12	92 42 32	52 39 11
	Oct., 23.74534	271 40 32	92 42 23	52 40 41
	Oct., 23.80168	271 36 18	92 42 23	52 40 41
	Oct., 23.76978	271 40 17	92 44 42	52 39 10
145	1823, Dec., 9.41449	274 18 32	303 1 18	76 9 40
	Dec., 9.43750	274 33 19	303 3 39	76 12 6
	Dec., 9.44697	274 34 14	303 3 51	76 12 14
	Dec., 9.44431	274 33 27	303 3 22	76 11 23
	Dec., 9.34767	273 56 12	302 59 14	76 2 45
	Dec., 9.44408	274 34 30	303 3 1	76 11 57
146	1824 (1), July, 11.51296	260 16 32	234 19 9	54 34 19
147	1824 (2), Sept., 29.2440	4 44 24	279 5 49	54 22 3

Logarithm Per distance.	Eccentricity.	Dir. of Mot.	Calculator	Authority.
9.70936	I	R.	Ursin,	A. N., 1, 311.
9.702905	I.	R.	Hansen,	A. N., i, 309.
9.70262	I.	R.	Nicollet,	A. N., 1, 311.
9.7027863	I.	R.	Nicollet,	Olb. Abh. (E.)
9.7026967	I.	R.	Gambart,	Z. C., vi, 479.
9.7025976	I.	R.	Gambart,	Olb. Abh. (E.)
9.70134	I.	R.	Encke,	A. J., 1825, 154.
9.70280	I	R.	Encke,	A. J., 1825, 155.
9.5388157	0.8445479	D.	Encke,	A. J., 1826, 126
9.5390382	0.8444643	D.	Encke,	Olb. Abh. (E.)
9.92258	I.	R.	v. Heiligenstem,	A. N., iv, 533.
9.92743	I.	R.	v. Heiligenstem,	A. N., iv, 534.
0.06182	I.	R.	Schnürlein,	A. N., 1, 350.
0.061390	I.	R.	Argelander,	A. N., 1, 393.
0.0602033	I	R.	Gambart,	Olb. and Santini.
0.0593320	I.	R.	Gambart,	Olb. Abh. (E.)
0.05923	I.	R.	Nicolai,	A. N., i, 395.
0.05932	I.	R.	Nicolai,	Z. C., vii, 562.
0.0614036	I.	R.	Hansen,	A. N., 1, 340
0.0597898	I.	R.	Hansen,	A. N., i, 363.
0.0593364	I	R.	Hansen,	A. N., 1, 493.
0.0596656	I	R.	Bouvard,	A. N., 1, 470.
0.0545019	0.96617805	R.	Encke,	A. N., 1, 372.
0.0581979	0.99147685	R.	Encke,	A. N., 1, 474
0.0593153	I.	R.	Encke,	A. N., 1, 476.
0.0592269	I.	R.	Rumker,	A. N., ii, 207.
0.0592179	0.992302221	R.	Rumker,	A. N., ii, 208
0.0588305	0.99630211	R.	Encke,	A. N., iii, 108.
9.35796	I	R.	Nicolai,	A. N., ii, 493
9.3553383	I.	R.	Nicolai,	A. N., iii, 109.
9.3553041	I.	R.	Schmidt,	A. J., 1827, 129.
9.3553934	I	R.	Hansen,	A. N., ii, 493.
9.3631982	I.	R.	Nicollet,	A. N., iii, 45
9.3550726	I.	R.	Encke,	A. N., iii, 113.
9.7717807	I.	R.	Rumker,	A. N., iv, 111.
0.0200454	I.	D.	Bouvard,	A. N., iii, 313

No.	Perihelion Passage. Greenwich Mean Time.	Longitude of Perihelion.	Longitude of Node	Inclination
		° ' "	° ' "	° ' "
147	1824 (2), Sept., 29 10187	4 34 12	279 15 9	54 34 14
	Sept., 29.08223	4 32 8	279 15 21	54 35 39
	Sept., 29.06644	4 32 6	279 16 44	54 35 32
148	1825 (1), May, 30.5458	273 55 21	20 5 53	56 41 17
	May, 30.49228	273 59 25	20 2 42	56 35 4
	May, 30.5421	273 55 43	20 5 45	56 41 10
	May, 30.55880	273 55 48	20 7 53	56 41 30
	May, 30.54628	273 55 22	20 6 29	56 41 6
149	1825 (2), Aug., 18.36031	9 47 54	193 4 52	88 29 39
	Aug., 18.71105	10 14 57	192 56 41	89 41 47
(104)	1825 (3), Sept., 16.27312	157 14 31	334 27 30	13 21 24
150	1825 (4), Dec., 11.45933	318 11 16	215 37 40	33 37 46
	Dec., 10.52125	319 11 57	215 48 8	33 27 49
	Dec., 10.77855	318 28 53	215 44 57	33 31 3
	Dec., 10.16370	318 49 5	215 39 18	33 29 19
	Dec., 10.42415	318 55 41	215 43 44	33 31 59
	Dec., 10.47758	318 49 56	215 42 46	33 34 59
	Dec., 10.68186	318 46 41	215 43 14	33 32 39
(92)	1826 (1), March, 18.41357	106 58 37	248 18 14	13 40 30
	March, 18.46535	109 53 40	251 27 31	13 32 52
	March, 18.46586	109 47 45	251 25 14	13 33 52
	March, 18.46231	109 51 23	251 26 10	13 33 15
	March, 18.41749	109 46 9	251 28 25	13 33 56
	March, 18.41218	109 46 0	251 28 23	13 33 51
151	1826 (2), April, 22.20363	115 7 52	198 23 33	40 40 12
	April, 21.91801	116 59 43	197 36 49	40 0 26
	April, 21.96143	116 54 56	197 38 25	40 2 33
	April, 21.97761	117 11 30	197 30 34	39 57 24
152	1826 (3), April, 26.95322	222 53 32	193 31 11	9 32 26
	April, 29.03904	35 48 1	40 29 1	5 17 2
153	1826 (4), Oct., 8.92879	57 45 13	44 6 11	25 52 48
	Oct., 8.95224	57 48 24	44 6 28	25 57 18
154	1826 (5), Nov., 18.45297	315 50 30	234 49 19	89 14 18
	Nov., 18.4053	315 31 32	235 14 19	89 25 17
	Nov., 18.29358	314 57 28	236 9 54	89 59 24

Logarithm Per distance.	Eccentricity.	Dir of Mot	Calculator.	Authority.
0 020998	I.	D.	Hansen,	A N , III, 321.
0 0211281	I.	D.	Argelander,	A N , III, 353
0 0211211	I.	D.	Encke,	A. N , IV, 123.
9 94896	I.	R.	Nicolai,	A. N , IV, 158,
9.9487426	I	R.	Schwerd,	A. N., IV, 180.
9 948965	I	R.	Gambart,	A N , IV, 226.
9 948964	I.	R.	Hansen,	Olb. Abh (E)
9.9489616	I.	R.	Clausen,	A. J., 1828, 152.
9 946198	I.	D.	Olbers,	A J , 1829, 121.
9 9461924	I.	D.	Clausen,	A. N., IV, 327.
9.5376348	0 8448885	D.	Encke,	Olb Abh (E.)
0.092180	0 9765025	R	Hansen,	A. N., IV, 260
0.0959054	I.	R.	Hallaschka,	A. J , 1829, 101.
0.0954613	0 9562466	R.	Rumker,	A. N., V, 86.
0.0930097	I.	R.	Tallquist,	A N., IV, 284
0.0942050	I.	R	Morstadt,	A. N , IV, 395.
0.0935430	I.	R.	Hansen,	A N., V, 31
0 0937189	0.9953690	R	Hansen,	A. N. V, 32.
9 96994	I.	D.	v Biela,	A N., IV, 507.
9 9551784	0 7455691	D	Clausen,	A. N , IV, 467.
9 9555154	0 7469033	D.	Clausen,	Olb Abh. (E)
9 9554135	0.7470093	D.	Gambart,	A. N., V, 125.
9.9554798	0.7465595	D.	Santini,	A N , XII, 115.
9.9554571	0.7465727	D.	Santini,	A. N., XII, 115.
0.3156647	0 9498736	D	Clausen,	A. N., IV, 366.
0 3027426	I.	D	Nicolai,	A. J., 1826, 172.
0 3034430	I.	D	Clausen,	A N., IV, 382.
0 3016581	I 0089597	D.	Nicolai,	A N., IV, 416.
9 8103306	I.	D	Flaugergues,	A N , XII, 282.
9 2744275	I.	R.	Clüver,	A. N., XII, 282.
9 93084	I.	D	Schwerd,	A N., V, 171.
9.930852	I.	D.	Argelander,	A. N., V, 358
8.4603416	I.	R.	Clausen,	A. N , V, 251.
8.42518	I.	R	Santini,	A. N , V, 258
8.364363	I.	R.	Gambart,	A N., V, 259.

No.	Perihelion Passage Greenwich Mean Time	Longitude of Perihelion	Longitude of Node	Inclination
154	1826 (5), Nov, 18 41516	° ' " 315 41 39	° ' " 235 13 33	° ' " 89 26 30
	Nov, 18 40827	315 29 38	235 6 10	89 22 9
	Nov, 18 41206	315 31 38	235 7 48	89 22 10
155	1827 (1), Feb, 4 92154	33 30 16	184 27 49	77 35 35
156	1827 (2), June, 7.8295	297 34 18	318 14 48	43 37 48
	June, 8.4112	297 31 42	318 10 28	43 38 45
157	1827 (3), Sept., 11.67486	250 58 13	149 39 4	54 3 19
	Sept., 11 67233	250 59 44	149 41 18	54 6 2
	Sept., 11 69286	250 57 16	149 39 14	54 4 42
(104)	1829, Jan, 9 74591	157 17 53	334 29 32	13 20 34
158	1830 (1), April, 9.01100	212 1 13	206 18 14	21 20 44
	April, 9 30182	212 11 47	206 21 44	21 16 29
	April, 9 364	212 13 30	206 22 0	21 16 0
	April, 9 30189	212 11 22	206 21 35	21 16 5
	April, 9 30062	212 11 44	206 21 52	21 16 28
159	April, 9 60506	212 23 19	206 22 43	21 11 9
	1830 (2), Dec., 27 6677	310 59 58	337 54 17	44 48 41
	Dec, 27.65838	310 59 35	337 53 9	44 44 32
(104)	Dec, 27 6604	310 59 19	337 53 7	44 45 30
	1832 (1), May, 3 97551	157 21 1	334 32 9	13 22 9
160	1832 (2), Sept, 25.52705	227 55 14	72 27 26	43 18 41
	Sept, 25 52156	227 55 36	72 26 42	43 18 3
(92)	1832 (3), Nov., 26 11999	110 0 54	248 15 36	13 13 12
	Nov, 26.12019	110 0 50	248 15 31	13 13 1
	Nov., 26.11687	110 0 20	248 15 13	13 13 31
161	1833, Sept, 11 054	229 4 50	324 58 18	7 0 50
	Sept, 10.186	222 51 14	323 0 48	7 21 2
162	1834, April, 11 262	323 18 32	269 56 29	6 9 22
	April, 2 66331	276 34 7	226 49 10	5 56 52
	April, 2.821	276 27 3	226 1 31	5 59 48
163	1835 (1), March, 28 16544	207 24 88	58 27 51	9 6 43
	March, 30 68738	206 9 36	58 56 9	9 2 42
	March, 27 57651	207 42 55	58 19 46	9 7 39
(104)	1835 (2), Aug., 26.36078	157 23 29	334 34 59	13 21 15

Logarithm Per distance	Eccentricity	Dir of Mot.	Calculator.	Authority.
8.4327879	I.	R.	Gambart,	Olb Abh. (E.)
8.4295812	I.	R	Gambart,	Olb. Abh. (E.)
8 4296128	I.	R	Cluver,	A. N., v, 433.
9 70460	I.	R	v. Heilgenstein,	A. N., v, 435.
9 90747	I.	R	Valz,	A. N., vi, 251.
9.907494	I.	R.	v Heilgenstein,	A. N., vi, 305.
9.1383010	I.	R	Nicolai,	A. N., vi, 49.
9 1391184	I.	R	Cluver,	A. N., vii, 62.
9 1393857	0 99927305	R.	Cluver,	A. N., vii, 62.
9.5385038	0.8446245	D	Encke,	Olb. Abh. (E.)
9 96392	I.	D	Schwerd,	A. N., viii, 299.
9 9644660	I.	D.	Nicolai,	A. N., viii, 319.
9 96454	I.	D.	Valz,	A. N., viii, 339
9.9644737	0 9993883	D.	} Haedencampf { and Mayer, {	A. N., ix, 171.
9 9644696	I.	D		A. N., ix, 172.
9 9650486	I.	D	Santini,	A. N., ix, 288.
9 0997368	I.	R	Peters,	A. N., ix, 148.
9 1000484	I.	R	Santini,	A. N., ix, 289.
9 0999822	I.	R	Wolfers,	A. N., x, 68
9 5358905	0 8454141	D	Encke,	Olb Abh. (E.)
0 0731607	I.	R	Peters,	A. N., x, 269.
0 0732061	I.	R.	E Bouvard,	A. N., x, 305.
9 9439975	0 7514674	D.	Santini,	A. N., xi, 6
9.9439963	0 7514681	D.	Santini,	A. N., xi, 6.
9 9440315	0 7514480	D	Baranowski,	A. N., xiv, 177.
9 689131	I	D	Henderson,	A. N., xii, 119.
9 66126	I	D.	Peters,	A. N., xii, 128.
9 889302	I	D.	Henderson,	A. N., xii, 120
9 7118304	I.	D	Petersen,	A. N., xii, 119.
9 70966	I.	D	Peters,	A. N., xii, 120
0 3104902	I.	R	v Boguslawski,	A. N., xii, 414
0.3120691	I.	R	Rümker,	A. N., xii, 416.
0 3099084	I.	R	W. Bessel,	A. N., xiii, 339.
9.5371089	0 8450356	D.	Encke,	Olb Abh. (E.)

No	Perihelion Passage Greenwich Mean Time	Longitude of Perihelion	Longitude of Node	Inclination.
		° ' "	° ' "	° ' "
(7)	1835 (3), Nov., 15.93741	304 31 53	55 9 59	17 45 11
	Nov., 15.93893	304 31 49	55 9 47	17 45 17
	Nov., 15.93925	304 31 31	55 9 59	17 45 5
	Nov., 15 93546	304 32 9	55 8 21	17 45 57
	Nov., 15 93927	304 31 34	55 9 59	17 45 5
	Nov., 15 93889	304 31 32	55 9 59	17 45 5
(104)	1838, Dec., 19 008912	157 27 35	334 36 32	13 21 29
	Dec., 19 01224	157 27 4	334 36 41	13 21 28
164	1840 (1), Jan., 4.48717	192 15 5	119 58 37	53 5 57
	Jan., 4 47111	192 12 17	119 57 54	53 5 41
	Jan., 4 47429	192 13 6	119 58 8	53 5 38
	Jan., 4.4891	192 14 45	120 0 30	53 6 27
	Jan., 4 42617	192 11 50	119 57 46	53 5 32
165	1840 (2), March, 12 43818	80 49 17	236 42 43	59 0 57
	March, 12 90032	80 23 3	236 48 3	59 13 22
	March, 12 90420	80 22 58	236 48 24	59 12 18
	March, 12 99064	80 18 20	236 49 16	59 13 20
	March, 12 93214	80 21 19	236 48 58	59 13 53
	March, 12 91305	80 22 9	236 48 22	59 13 34
	March, 12 92960	80 21 39	236 48 53	59 13 59
166	1840 (3), April, 2 5376	324 20 24	186 4 24	79 51 24
	April, 2 49544	324 12 40	186 2 57	79 51 52
167	1840 (4), Nov., 13 99272	22 24 49	248 39 43	58 19 25
	Nov., 13.9359	22 16 5	248 42 12	58 22 25
	Nov., 15 20803	23 42 30	248 47 42	58 5 3
	Nov., 13 98641	22 29 7	248 41 44	58 16 7
	Nov., 13.66421	22 31 59	248 55 51	57 57 52
	Nov., 13 64438	22 31 34	248 56 15	57 57 23
(104)	1842 (1), April, 12.01815	157 29 27	334 39 10	13 20 26
168	1842 (2), Dec., 16 065	325 37 28	206 10 24	71 18 50
	Dec., 15 95706	327 17 22	207 49 29	73 34 4
	Dec., 15.9567	327 16 13	207 49 1	73 33 37
(50)?	1843 (1), Feb., 27 43013	278 36 33	1 37 55	35 36 29
	Feb., 27.40036	278 28 16	0 6 32	35 52 44
	Feb., 27 43695	277 43 50	1 55 15	35 34 1
	Feb., 27 58939	280 44 0	15 56 59	34 19 52

Logarithm Per distance.	Eccentricity.	Dir of Mot	Calculator.	Authority.
9.7683432	0.96738912	R.	Rosenberger,	A. N., xiii, 71.
9.7683476	0.96738879	R.	Rosenberger,	A. N., xiii, 72.
9.7683203	0.96737396	R.	H. Westphalen,	A. N., xxv, 185.
9.7683515	0.9675509	R.	Stratford,	Naut. Alm., 1839, App.
9.7683264	0.96736929	R.	H. Westphalen,	A. N., xxv, 186.
9.7683194	0.96739091	R.	H. Westphalen,	A. N., xxv, 189.
9.5364759	0.8452202	D.	Bremiker,	A. N., xvi, 245.
9.5366085	0.8451775	D.	Encke,	Olb. Abh. (E.)
9.7911534	1.	D.	Rumker,	A. N., xvii, 110.
9.7913112	1.	D.	Lundahl,	A. N., xvii, 171.
9.791272	1.	D.	Petersen,	A. N., xvii, 113.
9.79134	1.	D.	Valz,	C. R., x, 198.
9.7913017	1.0002050	D.	Peters and O. Struve,	Olb. Abh. (E.)
0.08686	1.	R.	Koller,	A. N., xviii, 88.
0.0871180	1.	R.	Encke,	A. N., xvii, 190.
0.0869250	1.	R.	Plantamour,	A. N., xx, 329.
0.0868563	0.9978836	R.	Plantamour,	A. N., xx, 331.
0.0870136	1.	R.	Langier,	C. R., x, 466.
0.0870641	1.	R.	Mauvais,	C. R., x, 625.
0.0870571	1.	R.	E. Bouvard,	C. R., x, 711.
9.870434	1.	D.	Petersen,	A. N., xvii, 230.
9.8740948	1.	D.	Rümker,	A. N., xvii, 232.
0.172843	1.	D.	Encke,	A. N., xviii, 69.
0.1737630	1.	D.	Langier,	C. R., xi, 821.
0.16984	1.	D.	Santani,	A. N., xviii, 85.
0.172374	1.	D.	Encke,	A. N., xviii, 140.
0.1705436	0.97067165	D.	Götze,	A. N., xxi, 353.
0.1705070	0.96985265	D.	Gotze,	A. N., xxi, 247.
9.5378361	0.8447904	D.	Encke,	Olb. Abh. (E.)
9.69758	1.	R.	Valz,	C. R., xv, 1116.
9.7027970	1.	R.	Petersen,	A. N., xx, 274.
9.7026605	1.	R.	Langier,	C. R., xvi, 209.
7.7469647	1.	R.	Nicolai,	A. N., xx, 351.
7.7566666	0.9998174809	R.	Nicolai,	A. N., xx, 352.
7.8462789	1.	R.	} Kendall and } Walker,	A. N., xx, 393.
7.6131745	1.00090495	R.		A. N., xxi, 109.

No.	Perihelion Passage Greenwich Mean Time	Longitude of Perihelion.	Longitude of Node.	Inclination.
(50) ²	1843 (1), Feb., 27.46056	0 ' "	0 ' "	0 ' "
	Feb., 27 4290	279 2 30	4 15 25	35 12 38
	Feb., 27 33961	278 18 11	0 51 12	35 45 39
	Feb., 27.414015	278 17 33	357 52 4	36 20 33
	Feb., 27.414015	278 43 12	1 26 59	35 38 34
169	1843 (2), May, 6.90816	281 50 53	157 13 18	52 53 3
	May, 6.11874	281 32 31	157 14 40	52 45 34
	May, 6.11674	281 40 16	157 23 15	52 47 0
	May, 7.17812	282 21 28	157 10 36	53 0 11
	May, 6 17612	281 35 8	157 14 32	52 45 57
	May, 6 05853	281 29 52	157 14 42	52 44 55
	May, 6 02329	281 27 40	157 14 43	52 44 1
	May, 6 2873	281 46 5	157 15 47	52 51 51
	May, 6.05593	281 29 35	157 14 46	52 44 46
171	1843 (3), Oct., 19.04701	50 36 18	209 9 36	11 16 17
	Oct., 17.47790	49 44 48	209 25 58	11 21 28
	Oct., 16.88256	49 22 36	209 31 57	11 22 33
	Oct., 14 02871	49 33 49	209 30 49	11 23 0
	Oct., 17.87638	49 59 12	209 22 49	11 20 46
	Oct., 16.23612	48 54 23	209 45 2	11 22 57
	Oct., 16.92165	49 24 5	209 31 49	11 22 40
	Oct., 18 58016	50 18 54	209 13 21	11 16 50
	Oct., 17 07600	49 29 28	209 31 4	11 22 17
	Oct., 17 14786	49 34 9	209 29 9	11 22 31
(53) ²	1844 (1), Sept., 2 47594	342 30 49	63 48 32	2 54 46
	Sept., 2 50362	342 32 20	63 52 4	2 54 27
	Sept., 2.45430	342 29 42	63 48 53	2 55 2
	Sept., 2.47402	342 30 50	63 49 0	2 54 50
	Sept., 2.47745	342 30 59	63 49 14	2 54 45
172	1844 (2), Oct., 17.30961	180 21 39	31 40 54	48 36 40
	Oct., 17.35924	180 45 50	31 30 40	48 33 14
	Oct., 17 33461	180 46 13	31 30 52	48 32 54
	Oct., 17 32583	179 41 22	31 42 50	48 37 20
	Oct., 17.33822	180 23 45	31 38 55	48 36 24
	Oct., 17.33613	180 23 59	31 38 55	48 36 22
173	1844 (3), Dec., 13 50434	296 24 9	118 37 12	45 27 25
	Dec., 13 81124	295 45 39	118 21 4	45 37 50

Logarithm Per distance	Eccentricity	Dir. of Mot	Calculator	Authority.
7.717642	1.00021825	R.	Encke,	A N , xx, 304
7 76395	1.	R.	Plantamour,	A. N., xx, 343
7 7793757	0 99943383765	R.	Laugier and Mauvais,	C R , xvi, 924.
7.7392979	0.999936479	R.	Hubbard,	Camb Ast. Jour., ii, 57.
0.2097314	1.	D	Gotze,	A N , xxi, 52.
0.2086520	1.	D.	Mauvais,	A. N , xxi, 54.
0.2098129	1 014407	D.	Santini,	A. N., xxi, 136.
0 2109394	1.	D.	Graham,	A. N , xxi, 158.
0 2087542	1.	D.	Hind,	A N., xxi, 217.
0 2085600	1.	D.	Mauvais,	C. R , xvii, 888.
0 2083948	1.	D.	Gotze,	A N., xxi, 315.
0 209778	1.	D	Reslhuber,	A N., xxi, 370.
0 2085315	1 0001798	D.	Gotze,	A. N., xxiii, 71.
0 2285440	0.5457913	D.	Nicolai,	A. N., xxi, 249.
0 2284974	0.5541125	D	Goldschmidt,	A N , xxi, 281.
0.2279520	0.5562637	D.	Nicolai,	A N , xxi, 326.
0 2285935	0 5565615	D	Le Jeune,	A N , xxi, 338.
0 2287807	0.5526021	D.	Santini,	A N , xxi, 343
0 2264000	0 5555741	D.	O Struve and Liapunoff,	A N , xxii, 24 .
0.2280795	0 5565054	D.	Hind,	A. N , xxii, 62.
0 2281295	0 5477336	D	Faye,	C. R , xviii, 186.
0.2281165	0 5559644	D	Plantamour,	C. R., xviii, 309.
0.2285488	0 5559623	D	Levernier,	A. N., xxiii, 196.
0 0741755	0.6171574	D.	Nicolai,	A. N , xxii, 260.
0 0740861	0.6156601	D.	Hind,	A N , xxii, 269.
0 0742841	0.6186103	D	Goldschmidt,	A N., xxii, 278.
0 0742309	0.6176539	D.	Brunnow,	A. N., xxiv, 180.
0 0741950	0.61725587	D.	Faye,	C. R , xix, 1314.
9 9316534	1.	R.	Mauvais,	A. N., xxii, 129.
9 9353756	1.	R.	Graham,	A N., xxii, 209.
9 9352573	1.	R.	Graham,	A. N., xxii, 210.
9.9311082	1.	R.	Turazza,	A N., xxiii, 16
9.9321208	1.	R.	Nicolai,	A. N , xxiii, 21
9 9321180	1.	R.	Hind,	A N., xxiii, 197.
9.406448	1.	D.	Petersen,	A N., xxiii, 21.
9 395670	1.	D.	Brünnow and d'Arrest,	A. N , xxiii, 46.

No.	Perihelion Passage. Greenwich Mean Time.	Longitude of Perihelion.	Longitude of Node.	Inclination
173	1844 (3), Dec., 13.68294 Dec., 13.43188	0 0 30 296 58 13	0 23 22 114 59 5	45 36 34 46 49 3
174	1845 (1), Jan., 8.16003 Jan., 8.15863 Jan., 8.16212 Jan., 8.15588 Jan., 8.15893 Jan., 8.15698	91 20 0 91 20 6 91 20 8 91 19 40 91 19 58 91 19 42	336 44 20 336 44 50 336 44 33 336 44 31 336 44 32 336 44 31	46 50 35 46 50 56 46 50 43 46 50 30 46 50 30 46 50 36
175	1845 (2), April, 21.04124 April, 21.03290 April, 20.97093 April, 21.03098	192 34 29 192 33 21 192 29 21 192 33 34	347 7 15 347 6 41 347 5 50 347 7 0	56 22 51 56 24 6 56 27 18 56 23 36
176	1845 (3), June, 5.66314 June, 5.65798 June, 5.68300 June, 5.67342	262 11 9 262 6 31 262 0 54 262 3 17	337 55 16 337 53 4 337 49 11 337 49 18	49 5 53 49 8 22 48 55 8 48 41 59
(104)	1845 (4), Aug., 9.62627	157 44 21	334 19 33	13 7 34
177	1846 (1), Jan., 22.18100 Jan., 22.09387 Jan., 22.16008	89 7 8 89 6 25 89 6 3	111 5 30 111 8 29 111 5 41	47 26 56 47 26 6 47 28 7
(92)	1846 (2), Feb., 12.10194 P. Feb., 10.98766 Feb., 11.02331	107 10 4 109 2 26 109 2 16	240 51 45 245 54 45 245 44 36	13 28 41 12 34 53 12 39 45
(92)	1846 (2), Feb., 12.12333 S. Feb., 11.05401 Feb., 11.27164	107 13 17 109 2 45 108 56 23	240 54 54 245 56 7 245 46 52	13 25 3 12 34 13 12 43 15
178	1846 (3), Feb., 27.91842 Feb., 25.02227 Feb., 25.37406 Feb., 25.29903 Feb., 25.39314	116 34 18 116 24 0 116 28 22 116 28 1 116 28 24	95 20 13 103 31 33 102 41 6 102 51 13 102 37 40	33 47 17 30 30 30 30 55 53 30 48 37 30 57 51
179	1846 (4), March, 5.37963 March, 5.49947 March, 5.63997 March, 5.35599	89 25 44 90 16 28 90 36 13 89 16 50	76 57 43 77 29 56 77 26 50 76 49 35	85 19 19 85 11 30 84 59 56 85 34 58

Logarithm Per distance.	Eccentricity.	Dir. of Mot.	Calculator.	Authority.
9 4001230	I.	D.	Hind,	A. N., xxiii, 178.
9 5065345	I. 1015256	D.	Hind,	A. N., xxiii, 408.
9 9567469	I.	D.	Nicolai,	A. N., xxiii, 24.
9 9567565	I. 0003323	D.	Sievers,	A. N., xxiii, 31.
9.956754	I.	D.	d'Arrest,	A. N., xxiii, 81.
9.9567392	I.	D.	Götze,	A. N., xxiii, 167.
9 9567518	I.	D.	Nicolai,	A. N., xxiii, 170.
9.9567272	I.	D.	Goujon,	C. R., xx, 1314.
0 0984859	I.	D.	Götze,	A. N., xxiii, 125.
0 0985420	I.	D.	Hind,	A. N., xxiii, 224.
0 0987554	I. 0039886	D.	Jelinek and Hornstein,	A. N., xxiii, 277.
0 0985330	I.	D.	Faye,	C. R., xx, 1115.
9.60260	I.	R.	Reslhuber,	A. N., xxiii, 253.
9.602870	I.	R.	Santini,	A. N., xxiii, 267.
9 6032278	I.	R.	d'Arrest,	A. N., xxiii, 351.
9.603823	0.9898743	R.	d'Arrest,	A. N., xxiii, 352.
9 5291008	0 8474362	D.	Encke,	Olb. Abh. (E.)
0 1709303	I.	D.	Oudemans,	A. N., xxv, 203.
0.1704680	0 9924026	D.	Jelinek,	C. R., xxvi, 280.
0.1709043	I.	D.	Jelinek,	C. R., xxvi, 281.
9 9359333	I.	D.	Laugier,	C. R., xxi, 287.
9.9327011	0.7570030	D.	Plantamour,	A. N., xxv, 125.
9.9328143	0.7563402	D.	Coffin,	Amer. Alm., 1847.
9 9358437	I.	D.	Laugier,	C. R., xxi, 287.
9.9326965	0.7558991	D.	Plantamour,	A. N., xxv, 127.
9 9329456	0.7591178	D.	Coffin,	Amer. Alm., 1847.
9.8089600	I.	D.	Oudemans,	A. N., xxiv, 205.
9.8137465	0 7731257	D.	Willigen and Bierens de Haan,	A. N., xxiv, 206.
9 8129827	0.7933879	D.	Brunnow,	A. N., xxix, 377.
9.8131670	0.7892429	D.	Goujon,	C. R., xxi, 643.
9.8129409	0.7944593	D.	Hind,	C. R., xxvi, 605.
9 8248058	I.	D.	G Bond,	A. N., xxiv, 91.
9.8223747	0.9680761	D.	Peirce,	A. N., xxiv, 92.
9 8225463	0.9628484	D.	H. Breen,	A. N., xxiv, 181.
9.8245330	I.	D.	Van Deirse,	A. N., xxiv, 204.

No.	Perihelion Passage. Greenwich Mean Time.	Longitude of Perihelion.	Longitude of Node	Inclination.
		° ' "	° ' "	° ' "
179	1846 (4), March, 5 57777	90 34 55	77 35 45	84 57 13
	March, 5.15236	88 49 4	76 53 39	85 34 1
180	1846 (5), May, 20.13412	93 2 38	162 22 8	58 24 26
	May, 27.91453	82 32 35	161 18 27	57 35 50
	May, 25 94071	84 48 14	161 31 51	57 43 40
181	1846 (6), May, 29 61086	237 25 27	258 47 29	33 55 49
	June, 1.10468	239 50 12	260 12 46	31 2 14
	June, 1.21242	240 7 35	260 28 59	30 24 24
182	1846 (7), June, 5.24701	162 34 12	261 58 7	29 19 48
	June, 5.51808	162 1 16	261 51 36	29 18 47
	June, 5 24965	162 33 15	261 58 15	29 19 48
	June, 5.47921	162 6 2	261 53 12	29 18 47
183	1846 (8), Oct., 29.7831	98 34 24	4 40 9	49 40 44
	Oct, 29.74708	98 35 43	4 40 57	49 41 17
	Oct, 29.91663	98 47 19	4 38 22	49 39 3
184	1847 (1), March, 30.31327	276 2 57	21 48 33	48 33 34
	March, 30 27813	276 4 43	21 44 14	48 39 29
	March, 30.3223	275 46 42	21 37 44	48 32 23
	March, 30.2785	276 12 29	21 50 49	48 40 1
	March, 30 28783	275 59 24	21 36 49	48 39 45
	March, 30 27505	276 5 55	21 43 24	48 39 58
	March, 30 27886	276 2 33	21 40 8	48 40 0
185	1847 (2), June, 4 75503	141 34 1	173 56 26	79 34 7
	June, 4 69052	141 37 13	173 57 43	79 33 43
186	1847 (3), Aug., 8.19116	21 59 2	76 36 18	32 33 10
	Aug., 9.46479	21 12 34	76 48 25	32 38 27
	Aug., 9 34505	21 17 22	76 43 14	32 38 47
	Aug, 9.25914	21 20 33	76 42 2	32 38 24
	Aug., 9.32088	21 18 28	76 42 23	32 38 42
187	1847 (4), Aug., 8.44482	247 9 48	338 8 46	83 27 26
	Aug., 9.44226	246 42 4	338 18 1	83 27 1
188	1847 (5), Sept., 9 09539	79 22 28	310 29 42	19 24 38
	Sept., 9.06101	78 17 11	310 21 48	19 21 36
	Sept., 9.39988	78 56 0	309 58 11	19 12 9
	Sept., 9.54272	79 12 41	309 49 24	19 8 25

Logarithm Per distance	Eccentricity.	Dir. of Mot.	Calculator.	Authority.
9 8215848	0.9543895	D.	Hind,	A. N., xxiv, 381.
9.82524	1.	D.	Santini,	A. N., xxiv, 276.
0.0980169	1.	R.	Goujon,	C. R., xxiii, 479.
0.1387053	1.	R.	Argelander,	A. N., xxv, 83.
0.1314317	1.	R.	Brorsen,	A. N., xxv, 98.
0.204310	1.	D.	d'Arrest,	A. N., xxiv, 388.
0.186862	0.7567236	D.	d'Arrest,	A. N., xxiv, 388.
0.1842997	0.7213385	D.	C. H. A. Peters,	A. N., xxviii, 140.
9.8031613	1.	R.	Hind,	A. N., xxiv, 212.
9.8017037	0.98836046	R.	Wichmann,	A. N., xxiv, 241.
9.8030651	1.	R.	Oudemans,	A. N., xxiv, 297.
9.8018857	0.9899389	R.	Oudemans,	A. N., xxiv, 298.
9 919180	1.	D.	Powalky,	A. N., xxv, 99.
9.9193956	1.	D.	Hind,	A. N., xxv, 111.
9 9187601	0.993312712	D.	Quirling,	A. N., xxv, 253.
8 6358889	0.9993978302	D.	Quirling,	A. N., xxv, 301.
8.6272993	1.	D.	Schmidt,	A. N., xxv, 369.
8.6457238	0.9993425	D.	Villarceau,	C. R., xxiv, 449.
8.6233982	1.	D.	Villarceau,	C. R., xxiv, 563.
8.6300817	0.99991855853	D.	Graham,	C. R., xxiv, 900.
8.6262530	1.	D.	v. Littrow,	A. N., xxvi, 101.
8.6279502	1.	D.	v. Littrow,	A. N., xxvi, 101.
0.3255424	1.	R.	v. Littrow,	A. N., xxvi, 313.
0.3253373	1.	R.	Gautier,	A. N., xxvii, 33.
0.1698509	0.9603815	R.	W. Döllen and O. Struve,	A. N., xxvii, 324.
0.1718329	1.	R.	Pogson,	A. S. N., viii, 12.
0.1716651	1.	R.	Schweizer,	A. N., xxix, 170.
0.1715239	0.99743475	R.	Schweizer,	A. N., xxix, 168.
0.1716030	1.	R.	Schweizer,	A. N., xxix, 169.
0.2473722	1.	R.	Mauvais,	C. R., xxv, 149.
0.2472789	1.	R.	v. Littrow,	A. N., xxvii, 110.
9.686992	1.	D.	Niebour,	A. N., xxvi, 157.
9.695149	1.	D.	Schmidt,	A. N., xxvi, 179.
9.6901427	0.98043997	D.	Quirling and Niebour,	A. N., xxvi, 185.
9.6882986	0.9725603	D.	d'Arrest,	A. N., xxviii, 222.

No.	Perihelion Passage. Greenwich Mean Time.	Longitude of Perihelion.	Longitude of Node.	Inclination
189	1847 (6), Nov., 14.39381	0° 27' 4	0° 19' 49	0° 71' 47
	Nov., 14.40479	274 14 45	190 50 56	71 53 6
	Nov., 14.1763	274 26 13	190 55 58	72 10 51
	Nov., 14.41856	274 23 35	190 51 37	71 57 46
	Nov., 14.40316	274 11 42	190 51 5	71 49 37
	Nov., 14.499	274 10 6	189 35 29	71 33 32
190	1848 (1), Sept., 8 04429	310 34 21	211 31 44	84 22 55
	Sept., 8 05601	310 34 40	211 34 40	84 28 22
	Sept., 8 04625	310 38 53	211 35 44	84 30 24
	Sept., 8.04532	310 34 41	211 32 31	84 24 50
(104)	1848 (2), Nov., 26.11567	157 47 8	334 22 12	13 8 36
191	1849 (1), Jan., 19 35279	63 14 41	215 12 53	85 2 51
	Jan., 19 34994	63 14 22	215 12 54	85 2 54
	Jan., 19.34844	63 13 59	215 12 42	85 3 5
	Jan., 19 35269	63 14 31	215 13 1	85 3 3
	Jan., 19 34781	63 14 18	215 12 56	85 2 54
192	1849 (2), May, 26.48607	235 42 40	202 33 9	67 10 1
	May, 26 50812	235 44 35	202 33 21	67 8 55
	May, 26.49620	235 43 44	202 33 17	67 9 39
	May, 26.49803	235 43 48	202 33 15	67 9 19
193	1849 (3), June, 8.17345	267 4 35	30 32 12	66 57 32
	June, 8.016805	266 51 35	30 30 45	67 7 25
	June, 8.178636	267 4 15	30 32 0	66 58 33
	June, 8.173932	267 3 23	30 31 54	66 59 2
	June, 8.20364	267 6 30	30 32 22	66 55 19
194	1850 (1), July, 23.58672	273 25 42	92 53 46	68 13 19
	July, 23.44280	273 24 16	92 53 51	68 10 37
	July, 23 43556	273 26 33	92 56 42	68 8 3
	July, 23.52220	273 24 49	92 53 30	68 12 13
	July, 23.52021	273 24 32	92 53 29	68 12 5
	July, 23.51966	273 24 27	92 53 25	68 12 7
	July, 23.51956	273 24 26	92 53 24	68 12 8
195	1850 (2), Oct., 19.33836	89 13 59	206 1 49	40 3 45
	Oct., 19.34305	89 16 10	205 59 37	40 8 53
	Oct., 19.36809	89 27 58	205 53 46	40 22 27

Logarithm Per distance.	Eccentricity.	Dir. of Mot.	Calculator	Authority.
9.5164004	i.	R.	Niebour,	A. N., xxvi, 260.
9.5174122	i.	R.	d'Arrest,	A. N., xxvi, 275.
9.5184953	i.	R.	G. Rümker,	A. N., xxvi, 349.
9.5187597	i.	R.	Rümker,	A. S. N., viii, 25.
9.516912	i.	R.	Pogson,	A. S. N., viii, 25.
9.5331974	i.	R.	Miss Mitchell,	A. S. N., viii, 130.
9.5050880	i.	R.	Sonntag,	A. N., xxvii, 367.
9.5048748	i.	R.	G. Rümker,	A. N., xxvii, 368.
9.5052080	i.	R.	Schmidt,	A. N., xxvii, 370.
9.5050568	i.	R.	Sonntag and Quirling,	A. N., xxviii, 369.
9.5276717	0.8478281	D.	Encke,	A. N., xxvii, 115.
9.9821197	i.	D.	d'Arrest,	A. N., xxviii, 222.
9.9821432	i.	D.	Clausen,	A. N., xxviii, 315.
9.9821618	i.	D.	Hensel,	A. N., xxix, 290.
9.9821429	0.99998179626	D.	Safford,	A. S. N., ix, 109.
9.9821497	i.	D.	Petersen and Sonntag,	A. N., xxix, 305.
0.0642600	i.	D.	Weyer,	A. N., xxix, 13.
0.0641718	i.	D.	Plantamour,	A. N., xxix, 31.
0.0642040	i.	D.	Weyer,	A. N., xxx, 75.
0.0642078	i.	D.	Goujon,	A. N., xxx, 342.
9.9515556	i.	D.	Luther,	A. S. N., ix, 164.
9.9521130	1.0070657	D.	Schweizer,	A. N., xxx, 64.
9.9515984	i.	D.	d'Arrest,	A. N., xxxi, 102.
9.9516606	i.	D.	Schweizer,	A. N., xxxi, 123.
9.951525	0.9978312225	D.	d'Arrest,	A. N., xxx, 116.
0.0340853	i.	D.	Sonntag and Gotze,	A. N., xxxi, 16.
0.0339176	i.	D.	d'Arrest,	A. N., xxxi, 17.
0.0338532	i.	D.	Hind,	A. N., xxxi, 67.
0.0340197	i.	D.	Petersen and R. Schumacher,	A. N., xxxi, 79.
0.0340275	i.	D.	Villardeau,	A. N., xxxi, 227.
0.0340307	0.9999868	D.	Sonntag,	A. N., xxxiv, 177.
0.0340310	i.	D.	Sonntag,	A. N., xxxiv, 178.
9.752555	i.	D.	Niebour and G. Rümker,	A. N., xxxi, 211.
9.7522749	i.	D.	Mauvais,	A. N., xxxi, 219.
9.7509246	i.	D.	Quirling,	A. N., xxxi, 235.

No.	Perihelion Passage Greenwich Mean Time.	Longitude of Perihelion	Longitude of Node.	Inclination.
195	1850 (2), Oct., 19 3178	0° 3' 23"	206° 2' 5"	39° 45' 44"
	Oct., 19 34118	89 14 46	206 3 25	40 1 8
	Oct., 19.3433	89 20 17	205 55 47	40 10 52
	Oct., 19 35867	89 22 32	205 57 19	40 14 36
	Oct., 19 34043	89 14 34	206 0 4	40 5 37
	Oct., 19 273	88 56	206 27	39 19
	Oct., 19.35257	89 22 6	205 56 30	40 14 21
	Oct., 19.34851	89 20 31	206 1 0	40 6 53
(171)	1851 (1), April, 1 8056	49 41 38	209 31 19	11 21 39
196	1851 (2), July, 10.00287	324 7 45	148 13 11	14 4 2
	July, 8 94920	323 55 38	149 8 43	14 10 47
	July, 8 97292	324 10 27	149 21 52	14 14 41
	July, 9.02221	324 10 25	149 19 22	14 14 10
	July, 8 86652	323 36 25	148 54 31	14 5 41
	July, 8 70002	323 0 12	148 27 46	13 56 12
	July, 8 69157	322 59 49	148 27 41	13 56 4
197	1851 (3), Aug., 26 30561	311 13 25	223 9 50	37 43 57
	Aug., 26.22936	310 55 5	223 44 53	38 16 39
	Aug., 26.23463	310 59 22	223 41 6	38 9 2
198	1851 (4), Sept., 30.80052	338 45 13	44 24 54	73 59 18
	Sept., 30 79788	338 47 3	44 22 8	73 58 37
	Sept., 30 80597	338 46 9	44 29 27	74 0 39
	Sept., 30 79564	338 38 25	44 47 24	74 5 19
	Sept., 30 79993	338 45 56	44 26 14	73 59 44

Logarithm Per distance.	Eccentricity.	Dir of Mot	Calculator.	Authority.
9 75336	I.	D.	Graham,	A N., xxxi, 235.
9.752455	I.	D	Runkle,	A N , xxxi, 253.
9.751524	I.	D	Safford,	A. N., xxxi, 253.
9 751586	I.	D	d'Arrest,	A N., xxxi, 277.
9.752406	I.	D	Vogel,	A N , xxxi, 278.
9.7548	I.	D.	Valz,	A N., xxxi, 286.
9 7515290	I.	D.	J. Breen,	A. N , xxxi, 299.
9.751826	I.	D.	Reslhuber,	A N , xxxi, 330.
0.2303547	0 5549226	D.	Levernier,	C. R., xxxi, 790, 792.
0.0688536	0 6228820	D.	Pogson,	A S. N , xi, 219.
0.0727702	0.6890932	D	Vogel,	A. N., xxxiii, 47.
0.0737781	0.7036121	D.	Villardeau,	C R., xxxiii, 205.
0.073623	0 700015	D.	d'Arrest,	A. N., xxxiii, 34.
0 0716691	0.6793628	D	d'Arrest,	A. N., xxxiii, 44.
0.0696593	0 6608815	D.	d'Arrest,	A. N., xxxiii, 125.
0.0696476	0.6607426	D.	Villardeau,	C R., xxxiii, 460.
9.991833	I.	D.	Vogel,	A. N., xxxiii, 109.
9 9935340	I.	D.	Brorsen,	A. N., xxxiii, 117.
9 9931273	0 996851579	D.	Brorsen,	A N., xxxiii, 242.
9.1506705	I.	D.	Schonfeld and Lesser,	A. N , xxxiii, 339.
9 1521784	I.	D.	Khnkerfues,	A. N., xxxiii, 339.
9.1493178	I.	D.	J Breen,	A. N., xxxiii, 307.
9.140564	I.	D.	Kunes,	A. N., xxxiii, 336.
9.1503928	I.	D.	Götze and Sonntag,	A. N., xxxiii, 336.



NOTES.

—371.—D. u. "In the first year of the 102nd Olympiad, a burning torch, of extraordinary size, appeared for several nights." "This passage of Diodorus Siculus seems to fix the year of apparition of the comet. The 1st year of the 102nd Olympiad commenced in the month of July —371, the comet, as will be seen hereafter, appeared in winter. It should then be referred to the end of —371, or beginning of —370, this, however, cannot be done without difficulty."—(P.) Pingré then enters upon some chronological data, and concludes thus:—"I think, then, that we may adhere to the date given by Diodorus Siculus." He next quotes Aristotle as follows.—"When Aristæus exercised the authority of Supreme Magistrate at Athens, in the depth of winter this prodigious star was observed in the evening, in a clear sky. On the first day it was not seen; it set before the sun." (Note by P. "I translate faithfully. What can be Aristotle's meaning? Does he intend to convey, that, on the first day, the tail alone was seen, and that its head had set before the sun? But that is not possible, for, if the head had set before the sun, the tail, always opposed to the sun, should have been wholly below the horizon. Does he mean that the comet only appeared on the 2nd day of winter? Then again, how could Aristotle, who considered comets to be accidentally formed meteors, have said that the comet existed on the 1st day of winter, and that it had set before the sun. The first day one might have only seen the tail in strong twilight: Aristotle might have thought that the sun had not yet set. Perhaps, also, the light of the comet on the second day might have persuaded Aristotle that it had existed on the previous day.") "It was perceived the second day, the sun having left it behind him, although at a very short distance; it set forthwith after the sun. But its light, viz. its tail, stretched out like an alley of trees, to one third of the sky, which gave it the name of 'road;' it reached to the girdle of Orion, where it vanished." P. then remarks, that it hence followed, that the apparent course of this comet was direct, or from west to east, but that its real motion was, probably, retrograde. Since, at the beginning of its appearance, the sun was in Capricorn, and the comet, near the sun, appeared at the setting of the equinoxes, and set shortly after the sun, the L. must have been at first less than that of the sun, and its northern l. could not have been less than 20°. The comet having disappeared about the girdle of Orion, it

must have then had a southern l. of about 20° or 25° , it had then passed its descending node during the time of its apparition, and as its motion was at first very rapid, and as there is reason to believe that it was then pretty near the earth, one may conjecture, with some confidence, that it passed its descending node but few days after its appearance and conjunction with the sun. its descending node was thus probably in Cancer or Leo. From the brilliancy and length of its tail we are able to assume that, when it first appeared, it was not far from its P. P. I am even persuaded that it had already passed it, otherwise it could not have departed from the sun, so far as it appeared to have done when Aristotle obs. it near the girdle of Orion. Pingré next expresses his belief that the P. was in Libra or Virgo, its distance much less from the sun than from the earth, and that the inclination of the orbit exceeded 30° . He saw no resemblance to it in any other comet. —(P., v. 1, pp. 259–262). Would he have made this last remark had he seen the comet of 1843 (1)?

—136.—D. u. “I unite, here, three comets which are probably one and the same. I. M. Emilius, C. Hostilius Mancinus, being consuls, a burning torch was seen in the heavens, at Prænestum. Authors of great weight, if we must believe cometographers of very slender authority, attest, that, two years later, a comet was seen in Gemini during 83 days. II. Under the reign of Attala a comet was seen, small at first, but its size increased. It reached the equinoctial circle; it equalled in extent (i.e. probably that its tail equalled in width) that part of the heavens called the Milky Way. This Attala appears to be the third person of that name, king of Pergamos, who established, as his universal heir, the Roman republic. He ascended the throne in 138 or 137, and reigned only 5 years. Thus, this comet may have appeared in 136. III. At the birth of Mithridates a comet appeared, and lasted 70 days. The heavens seemed to be on fire. The comet was situated in the fourth part, and its light was superior to that of the sun. It occupied four hours both in rising and setting. It is difficult to determine the date of the birth of Mithridates. He certainly died in 62. Orosius assigns to him 75 years’ lifetime. Eutropus only 70. Thus, he would have been born in 137 or 134. Can the comet of which Justinus speaks be the following (134)? According to Appian, Mithridates lived only 68 or 69 years, which would place his birth about 131.”—(P., v. 1, p. 269.) An orbit is given for —137, referring to M. Eq. 1850.0 from the American Almanac, 1847.

—69.—D. u. “Early in the night of the 23rd July, an extraordinary star appeared between the Kio (angles), to the right and left. (Note. No Chinese planisphere gives this name, which is found in the history of the Han, as also in Ma-touan-lin. Kio is a group composed of α , ζ ,

Virginis. *Ta-kio* is Arcturus. If we read Tchu instead of Kio, the two stars indicated will be α and ι Draconis.) It was directed towards the south-east. Its length might be 2° . The colour was white. On the 20th August an extraordinary star also appeared. It was seen to the north-east of Corona Borealis. It moved southwards from the north; and was seen until the night of the 27th August, when it entered the zone of stars in Ophiuchus and Serpens, round α Herculis and α Ophiuchi. Its brilliant *chevelure* was directed to the S.E., and its colour was white."—(Biot. C. T., 1846, Supp. p. 61.) An orbit of this comet is given, referred to M. Eq. 1850.0, from American Almanac, 1847.

—68.—D. u. "In China, under the rule of Suen-ti, on the 23rd July, Julian year, a comet was seen during the night. On the 20th August it moved in a southerly direction. During the night of the 27th August it was in Tien-chi. The Tien-che is that part of the heavens included between the equator and the circle of perpetual apparition of the stars, to the north of Libra and Scorpio. The head of Hercules occupies pretty nearly the centre. P. de Mailla stated that in the spring of 69 a comet appeared in the west."—(P., v. 1, p. 276.) There seems to be little doubt of —69 and —68 being the same phenomenon.

—11.—D. u. "Under the consulate of M. Valerius Messala Barbatus and P. Sulpitius Quirinus, and before the death of Agrippa, a comet was seen for many days. It appeared to be suspended over the city of Rome, and, subsequently, became separated into many little torches."—(Dio Cas. l. lrv.) "It will not be expected, undoubtedly, that in each page I should treat as imaginations these suspensions and dissolutions of comets, especially when they are not attested by cotemporary and ocular witnesses. Seneca, more ancient than Dion, confuted those who believed in these dissolutions, and, no doubt, ignored this, because he makes no opposition to it. As to the comet itself, it was obs. in China during the reign of Tching-ti, first year, on the 25th August. It was in the constellation Tsing (feet and thighs of Gemini). The comet then passed over the stars in the left hand of Castor; it appeared to the north of Aquila, passed to the stars of Leo and Virgo, was seen near Arcturus, and reached the stars of Tien-che, (the portion of the heavens which includes Corona Borealis, the head of Hercules and Serpentarius, and almost all the body of these two constellations.) This comet appeared during 63 days. An error has crept into this description. The *north of Aquila* has no connexion with the rest of the route assigned to this comet. I fancy that, 'to the north of Cancer,' or simply 'Cancer,' should be the reading. Struyck did not doubt the identity of this comet and that of 1661 of the Christian era."—(P., v. 1, p. 280.) The orbit given in the Catalogue is referable to the same epoch as the others.

It is to be regretted that no further information on the preceding

comets can be given by the compiler, as it seems to him most improbable that Mr. Peirce had not stronger data than are here recorded, for the ground-work of his orbits.

66.—D. u. This comet was seen in China on 20th February, in Capricorn. The tail was 8° in length. It passed through Sagittarius, and to the south of the head of Scorpio, and was visible for 50 days.—(P., v. 1, p. 288) The orbit given was computed on the supposition, that its 50 days of apparition commenced on 20th February, and not 31st January, which Mr. Hind conceives to have been implied. The L. is counted from the equinox of the year, and the time of P. P. for the Julian style —(A. N., No 634—C. T., 1846, Supp. p. 62) The L. of node is 32° 40' according to C. R.

240.—D. u. The elements were calculated from the Chinese observations, which are rather doubtful. Mr. Burckhardt's object was merely to ascertain if any of these ancient comets bore any resemblance to those of modern times, which were better observed.—(D, v. 3, p. 418.) It was first seen in China on 10th November, in the tail of Scorpio, with a train of 30° in length. It is stated to have been in conjunction with Venus, which was in Capricornus, until 5th December, when she entered Aquarius, and, on 19th December, the comet was between Aquarius and Cetus. Its latitude was southern during its visibility.—(P., v. 1, p. 298.)

451.—D. u. "In the 28th year of the reign of Valentinian 3rd, Attila arrived in Gaul, and was defeated by Aetius. A comet appeared on the 10th June. On the 29th, after having seen it early in the morning, in the east, it was first obs., after sun-set, in the west. On the 1st August (M. Laugier says, 'read the 1st July,') it showed itself in the west."—(P, v. 1, pp. 312-13) He speaks of two eclipses of the moon, one on the morning of the 2nd April, the other on the night of 26th September. These eclipses decide the year of the apparition of the comet. This is confirmed by the Chinese annals, from which Laugier gives this extract—"In 451, on the 17th May, a comet was seen in the stellar division Mao (determining star being η Pleiadum) On the 13th July, it was in the middle of Thai-wei, near the throne of the five sovereigns," (β Leonis). Laugier has shown that, with the supposition of P. P. 451, July 3.5, the orbit of Halley's comet represents these obs. This is then, very probably, the earliest ascertained apparition of Halley's comet.

539.—D. u. The orbit is from Chinese obs. which do not give the l. Thus, the inclination and the node cannot be well determined.—(D., v. 3, p. 418.) It was obs. in China on 17th November, in Sagittarius, with a tail 10 feet long !! The statement, that, on 1st January, 540, it was within 3° of Venus, is not easily to be explained. On its

arrival in the head of Aries it began to wave. This was on 30th January.—(P, v. 1, p. 319.)

565.—D. u. Elements from two Chinese obs. There is but little certainty as to the node and inclination. The orbit has some resemblance to those of the comets of 1683 and 1739, but the latter do not agree with the obs. of 565.—(D., v. 3, p. 418.) This comet was seen in China on 4th August, in Ursa Major: its tail being then only a few tenths of a degree in length. It passed into Aquarius and Pegasus, the tail increasing to 10° . After 100 days it was in Equuleus.—(P., v. 1, p. 322.)

568.—D. u. M. Laugier's elements were computed from the Chinese obs. given by M. E. Biot in C. T.—(C. R., v. 22, p. 155.) Mr. Hind's also from the same.—(A. N., No. 498) Its physical constitution, as described by the Chinese, is mere stuff. It is said to have lasted 69 days.—(C. T., 1846, Supp. p. 65.) Its tail was 40° long.—(P., v. 1, p. 323.) Pingré reports two comets in this year.

574.—D. u. Mr. Hind called these elements "very uncertain." They are derived from the Chinese obs. reported by M. E. Biot.—(A. N., No. 498) The Chinese said that it was of the size of a peach!! and was seen for 93 days; which M. Biot thought should be interpreted 63 days.—(C. T., 1846, Supp. p. 65.) All that Pingré mentions is the fact of its appearance.

760.—D. u. In the 20th year of the reign of Constantine, the sun was eclipsed on a Friday, the 15th August, about the 10th hour of the day. In the same year a very brilliant comet, in the form of a beam, appeared in the East for 10 days, and then in the West for 21 days. It was seen in China for 59 days. On the 16th May it was 4° in length, being between the constellations Musca and the horns of Aries. It passed by the Pleiades, the Hyades, λ , ϕ Orionis, feet and thighs of Gemini, θ , η , γ , δ , Cancrī, head of Hydra, and lastly, traversing Leo, reached β Virginis.—(P., v. 1, pp. 336-7) M. Laugier extracted the following from the Chinese annals:—"760, 16th May, a comet (star-broom) appeared in the East. It was between the region of β Arietis and α Muscæ. Its colour was white. It was 4° in length. It moved rapidly towards the East. It traversed the region of η Pleiadum, of ϵ Tauri, of λ Orionis, of δ Orionis, of μ Gemino, of θ Cancrī, of δ Hydræ, and the group α , γ , ζ , Leonis. It reached to the West of β Virginis. Its apparition lasted 50 days, and it was not afterwards seen." With a P. P. 760, June 11, M. Laugier has reconciled the orbit of Halley's comet with all these particulars, and he hence concludes their identity.

770.—D. u. Mr. Hind stated that in calculating the elements for this comet, and also those for the comets of 962, 1433, and 1490, he made the Chinese descriptions of their paths the foundation of his

computations, although occasionally influenced by European accounts, where they were particularly explicit. He thought his orbit of this comet more uncertain than the rest.—(A. N., No. 551.) M. Laugier derived his elements from the account given by M. E. Biot, wherein he reports that it appeared in China on 26th May, and was an extraordinary phenomenon, with a train of about 30° in length.—(C. T., 1846, p. 79.) Pingré does not notice it.

837.—D. u. Orbit deduced from the Chinese obs., the detail of which would be quite too extended for a note. The tail on its appearance on 22nd March was 7° long. On 6th April it had increased to 10° , and on the 10th to 50° , and was divided into two streams of light. On the 11th of same month it reached to 66° , but was no longer divided. On the 14th it extended to 80° , and on 28th it had decreased to 3° , after which time it was not seen.—(P., v. 1, p. 340.)

961.—D. u. On the 28th January, 962, (Period Kien-loung 2nd year, 12th moon, day, Ki-yeou,) an extraordinary star appeared within the precincts of the celestial motions, to the east of the group of stars Thsoug-jin, (k, n, o, p, q, Tauri Poniatowski, near γ Ophiuchi.) It had no visible tail. On the 19th February, 962, (same period, 3d year, 1st moon, day, Sin-ouci,) it had moved in a Southerly direction and entered the group of the stellar division T₁, (that of α Libræ.) In the 2nd moon, day, Kouei-tcheou (2d April) it reached the seven stars, Tsi-sing, (the division of α Hydræ,) and disappeared. (From Chinese Annals, Biot, C. T., 1846). Hind computed his orbit from the Chinese obs.

989.—D. u. The elements were deduced from the Chinese obs. and are doubtful.—(D, v. 3, p. 418.) It would appear that three or four comets were seen this year, and that this orbit refers to the last. It was observed in China on the 5th August in Gemini. Pingré was of opinion that this comet should not have been confounded, as it was by some, with a comet which is said to have appeared in 995.—(P., v. 1, pp. 358-9.) It had little or no coma, and its apparent motion was S.W.—(C. T., 1846, p. 66.)

1066.—D. u. The orbit given is not included in Pingré's Catalogue, but is to be found in the text on this comet. His remarks are of great length; let it suffice to say that it was very splendid, that the period of its visibility is very uncertain, but that Pingré favoured the term of about forty days; that the length of the tail varied from 3° to 15° , and that on 26th April it emitted three rays. Struyck identified this comet with that of 1665, but Pingré thought it to be more similar to that of 1677.—(P., v. 1, pp. 373-8.) de Zach stated that it was of the size of the full moon; that rays proceeded from it extending far, and illuminating the entire southern sky. He added that Pingré cited 24 historians who had written on this enormous comet,

but that he failed to mention that it was represented on a piece of tapestry in the Cathedral of Bayeux. It there appears as a great flowing star, with rays on one side forming a circle, or a species of rayed crown.—(Z C, v. 8, pp. 394-6.)

1092.—D. u. The elements represent very well all that is related in the C. T., 1846, p. 67, after correcting one mistake, probably an error of the press. The day Jin-tseu does not answer to January 9, but to the 19th of that month. This comet approached pretty near to the earth.—(A. N., No. 634.) In the C. T., as above, it is stated that the comet appeared in China on the 8th January, in Orion, passed through Lepus, and on the 9th January, was in Eridanus. On 30th it was in Andromeda, and on 7th May disappeared. Pingré mentioned two comets in this year; to one of which he attributed an error for 1096, and the other he called a meteor.—(P., v. 1, p. 379.)

1097.—D. u. Burckhardt computed his elements from Chinese obs. of 6th, 16th, and 17th October.—(D., v. 3, p. 418.) This was a very remarkable comet, but was visible a very short time. It appears to have been discovered on 30th September, and was seen in Europe for 15 days from this date. Its tail was double according to some, single as described by others. In China it was seen on 6th October, 30° in length, and on the 9th of that month it had increased to 50° .—(P., v. 1, p. 381) Baron de Humboldt, in writing to M. Arago upon comet 1840 (2), stated it to be his opinion that it was the same as this of 1097, and also as that of 1468; thus giving a period of about 370 years. He also stated that the comet 1840 (2) had two secondary trains. M. Arago appears to have coincided in opinion with M. de Humboldt.—(C. R., v. 10, pp. 534-5)

1231.—D. u. Obs. in China on 6th February in Cygnus. It was of the magnitude of Saturn, and passed through Lyra, traversing the Equator on the 24th. Pingré considered that his elements represented the obs. pretty well.—(P., v. 1, p. 401.) M. E. Biot could not find mention made of this comet in Gaubil's Catalogue.—(C. T., 1846, pp. 45 and 73)

1264.—D. u. Orbit doubtful. It is supposed to be the same as that of 1556.—(D., v. 3, p. 418.) There is a long dissertation on this comet by Pingré in the H. A. for the year 1760, pp. 179-203. He stated that Dunthorne's orbit is in the Ph. T. for 1751, and cited numerous authorities of a nature quite too prolix to transcribe. He seems to have placed much reliance upon his own elements; and he compared them and Dunthorne's with those of the comet of 1556, computed by Halley. Again, in his *Cometographie* he referred to his paper in the H. A., and gave several details of the comet's apparent motion. He stated that it was seen in France possibly from the 14th July, but

certainly from the 17th, in the evening after sunset. Also that it appeared that it was seen in the morning from the 22nd or 25th July, in North East; and that its tail or rays were seen for a long time before the head or nucleus rose above the horizon. He added that it was seen in China on the 26th July, when its tail was 100° in length. It was visible for four months. He concluded by expressing his belief that it was identical with that of 1556, and that its return might be expected in 1848, the period having been assumed to be 282 years—(P. v. 1, pp. 406–411.) See Z. C., v. 5, p. 342, also P. T. Ab, v. 10, p. 209. For further remarks see note on comet 1844 (3).

1299.—D. u. First seen in China on 24th January, and was visible for 76 days. It was also seen in Europe at the end of January. The head pretty large, and the tail long, relatively to the head. The European obs do not agree. Pingré made useless efforts to arrive at the theory of the orbit of this comet. He supposed that the first obs. was made on 31st January, and the second on the day following, St. Mathias (or 24th February, N. S.) He conceived that he had no fruit of his labour, except the conviction that these two obs. were utterly irreconcilable with the obs. of 5th March. However the obs. of 24th January, made in China, although excluding that made in Europe at the end of the same month, agrees with those of the 25th January and 5th March. His orbit resulted from a combination of these obs.—(P., v. 1, pp. 418–9) Of course the elements are very doubtful.

1301 (1).—D. u. Pingré spoke of two comets in this year, but of one there do not appear to have been any obs. It is, therefore, to be presumed that the orbits given by Pingré and M. Laugier refer to the same phenomenon. However, as there is so great a discrepancy between P. P., L. P., and L. N., it has been thought better to number them as if they were orbits of distinct comets.

1301 (2).—D. u. Delambre stated that it was the opinion of Flaugergues that this comet might be the same as that of 1811 (1)—(D., v. 3, p. 418.) Pingré called the first in his notices a great comet, and stated that it was seen from the 1st September, and in China on 16th September, with a tail of 5° in length, extending subsequently to 10° . Of the second he merely remarked that it was seen in the West before Christmas, that it set before midnight, and that it was visible 15 days, adding that it was viewed in Iceland, Norway, and at Rome.—(P., v. 1, pp. 420–3.) Nothing can be more rough than his orbit. It can be in no degree depended on. The greatness of the inclination may perhaps account for the contending heliocentric motions. M. Biot takes no notice of a second comet. M. Laugier computed his elements from the position of 16th September, reported by the Chinese, and two obs. made at Cambridge on 30th September and 6th October mentioned by Dunthorne in the

Ph. T., v. 47 M. Laugier attributed to Pingré a misrepresentation of the Chinese text, which resulted in his rejection of the Cambridge obs. He added that his elements effaced any trace of analogy between this comet and that which he had discovered (see 1842 (2)), but that they at least substituted a real comet for a fictitious one.—(C. R., v. 15, p. 950.) See P. T. Ab., v. 10, p. 211.

1337.—D. u. Halley's orbit represents the Chinese obs. only within 20', that of Pingré must be much better.—(D, v. 3, p. 418) Pingré mentioned two comets in this year the first is the one in question; the second does not seem to have been observed at all, and was not seen in China. The first appeared in China in the month of May, and according to Gaubil, was obs. for 63 days. On the 26th June the tail was only 1° in length. In Europe it was seen at the beginning of June.—(P., v. 1, p. 429) On the 30th June the train had increased to 2° and on 8th July to 3°.—(C. T., 1846, p. 47.) M. Laugier's orbit was computed from the data given by M. E. Biot; the obs. selected being those of the 14th July, 4th and 19th August, and he showed that his elements represented satisfactorily both the Chinese and European obs.—(C. R., v. 22, p. 153.)

1351.—D. u. Four Chinese obs. but no l.—(D., v. 3, p. 419.) It was seen on 24th November and 26th, 29th, and 30th of same month, and was described to be small.—(P., v. 1, p. 437, C. T., 1846, p. 48) Burckhardt stated that his elements could only be considered an approximation. He added that on 30th November it was only 0.1 distant from the earth, and expressed his surprise that it was not seen for a longer period in China.—(Z. C., v. 16, p. 504.)

1362.—D. u. Elements from three obs., but the third gives no l.—(D, v. 3, p. 419) There are two comets noted by Pingré for this year, and it appears to be doubtful whether or not there was a third. The orbits given are for the first. This was seen in China on 5th March, and between the 17th March and 1st April the tail was 20 feet long!! At this latter date it had no tail, and it disappeared on 7th April.—(P., v. 1, p. 438.) M. E. Biot stated that the tail was 20° long, and that the comet was seen on the 1st April in the form of a star without nebulosity, and of the size of a wine glass!!—(C. T., 1846, p. 49.)

1366.—On the day Keng-tsé, the eighth moon, (26th August,) in the 26th year Tchi-tching, a comet was seen in China in the Pé-téou, (Ursa Major.) On the following day it was in 18° 50' of the constellation Ouy, (tail of Scorpio) On the 29th August in 9° 90' of the constellation Nu, (ϵ , μ of Aquarius) On the 30th in 0° 80' of the constellation Hiu, (β Aquarii and Equuleus.) P. de Maille stated that this

comet appeared in the *ninth* moon, in the north-east. we must read, undoubtedly, the eighth moon.—(P., v. 1, p. 441.)

1378.—During the ninth moon, which commenced in China about the 22nd September, a comet traversed the stars in the western foot of Antinous. It was also seen in Europe. On the 29th September it was near Ursa Major, between Aries and Taurus. Its motion was very rapid and contrary to the order of the signs; it was seen for only five days. There is some obscurity in this. Ursa Major is very far from Aries and Taurus. It is very possible that the comet passed from Antinous to Ursa Major, but scarcely proceeded thence to Aries and Taurus. According to Struyck this comet is the same as that of 1652.—(P., v. 1, p. 442.) M. E. Biot obtained from Chinese records the following obs. which were unknown to Halley and Pingré—"1378, 26th September, (period Loung-wou, 11th year, 9th moon, day, Kia-su,) an extraordinary star was seen to the north-east of the five cars, (α , β , θ , ι Aurigæ β Tauri) It had a radiant coma of a length of about 10° . It swept the group Neï-kiai, (τ , ι Ursæ Maj,) entered the borders of Tse-wei, (tail of Draco,) swept the five stars of the north pole, (the polar star and four small stars, set down in Chinese maps, round the pole,) passed over the Chao-tsai of the eastern wall, (η Draconis,) entered the limits of the 'marché celeste,' (girdle of stars of Ophiuchus and α Herculis,) and continued in the 'marché celeste,' till the 10th moon, day Ki-ouei, (10th November,) when the weather became cloudy, and it was not again seen." M. Laugier, by retrogressively reducing the orbit of Halley's comet to the equinox of that period, found that, with the data of P. P. given in the table, these obs. were well represented.—(C. R., v. 16, pp 1004-5.)

1385.—D. u. Seen in China on 23rd October. A comet was also seen on 30th October, in Hydra and Cratera, and one in the Southern part of Hydra. Gaubil presented these as three distinct comets, but Pingré recognised only one.—(P., v. 1, p. 444.) Mr. Hind considered his elements of this comet to be more certain than those of the comets 568 (2) and 574.—(A. N., No. 498.) The tail was 10° long.—(C. T., 1846, p. 57.)

1433.—D. u. M. Laugier computed his orbit from the Chinese obs. given by M. E. Biot, in C. T., 1846, p. 51, and said that it gave the middle place very well.—(C. R., v. 22, p. 151.) Mr. Hind's is from the same data, and the elements have considerable resemblance to those of the comet of 1780, calculated by M. Olbers.—(C. T., v. 21, p. 1075.) Pingré called it remarkable and brilliant, seen in Poland from night till morning, and lasted nearly three months.—(P., v. 1, p. 453.) The date of its first appearance seems to be doubtful. On the 15th of Sep-

tember the tail, as seen in China, was more than 10° in length, and lasted for 24 days.—(C. T., 1846, p. 51.)

1456.—D. u. One of the apparitions of the celebrated comet bearing the name of Halley. Length of the tail 60° , but variable, and under some circumstances showing none whatever. In the beginning of June the head was round, and of the size of a bull's eye!! with a tail like that of a peacock!! On the 6th of this month its nucleus was as brilliant as a fixed star; which was also remarked on its return in 1682, and the length of the train was then 22° . It follows from Pingré's elements that, at the end of May, the earth was equi-distant from the comet and the sun. On the 1st July the comet was distant from the earth about three-fourths of the mean distance of the earth from the sun. Its visibility continued for a month or more —(P., v. 1, p. 459.) The Chinese obs., reported by M. E. Biot, give 7° as the greatest extent of the tail —(C. T., 1846, p. 52.)

1457.—D. u. This is the comet described by Ebendorffer. The L. is counted from the equinox of the year, and the time of P. P. for the Julian style.—(A. N., No. 634) It was very small, and on the 8th June its tail, very long at first, $=15^\circ$. It resembled a very straight lance. The livid colour of the comet was like lead. Its apparent motion direct.—(P., v. 1, pp. 464-5.) On the 15th June the tail was $1\frac{1}{2}^\circ$ in length, and on the 22nd about 10° .—(C. T., 1846, p. 52.)

1468.—D. u. The second that appeared this year. It was small, had a white tail, and was first seen about the beginning of October.—(P., v. 1, pp. 467-8) M. Laugier's orbit was computed from the data given in C. T., and the obs. mentioned by Pingré. He noticed a considerable resemblance between these elements and those of the comet of 1799, and had some suspicion that they were identical with that of 1299 —(C. R., v. 22, p. 148.) M. Valz's orbit was founded on the assumption that the comet was in conjunction with α Ophiuchi on the 16th October, and not with α Herculis, as laid down by M. Laugier. He was also of opinion that this comet and that of 1799 were identical.—(C. R., v. 22, pp. 424-5.) On the 18th September, the train extended over 30° .—(C. T., 1846, p. 52)

1472.—D. u. The first comet that appeared this year. In the month of December, 1471, a fine comet was seen in China. Its tail is described to have been as long as a street!! Its apparent motion was so prodigious, that, in one day, it passed through four signs of the zodiac. It was also seen in Europe. Halley calculated his orbit from the obs. of Regiomontanus, who stated, that, on 13th January, the diameter of the head $=11'$; and that of the coma $=34'$, (a statement which the writer does not very well comprehend.)—(P., v. 1, 471-6) M. Laugier's elements were founded on the Chinese obs. given in the C. T., 1846,

P. 53, and he showed that the calculated places agreed very well with the obs.; and that the comet approached the earth within 0.033 of the solar distance from it.—(C. R., v. 22, pp. 152-3)

1490.—D. u. Pingré dated this comet for 1491. He said that it had a very long, faint, white tail, and lasted only a few days. It was seen in Poland until the middle of February. It followed the sun after his setting, and its tail was turned towards the East.—(P., v. 1, p. 478) Mr. Hind thought that this comet bore some similarity to that of Bremicker, 1840 (4), which ought to have appeared about this year, according to the excellent investigation of M. Gotze. The P. D. being however different, Mr. Hind was inclined to think that the elements of 1840 (4) would not satisfy the Chinese obs. of 1490. The time of P. P. is given for old style, and L. referred to the equinox of the year.—(A. N., No. 551.) If Mr. Hind's orbit be at all approximatively correct, there is an end to any conjecture of its identity with 1843 (1). On Hind's and Peirce's orbits it may be observed, that Pingré noticed one comet towards the beginning and another towards the end of 1491. It is impossible that either of these orbits could apply to the latter, as this would cause its visibility for an entire year after its P. P., but Pingré suggested that there might have been a mistake of a year, and that it was identical with the former. All must be uncertain, unless there be better data than those which were in the possession of Pingré. The principal difficulty was whether or not Hind and Peirce referred to the same comet. Having a strong impression that there were not data at this period referring to two comets, from whence orbits could be deduced, the writer requested Mr. Graham to endeavour to ascertain whether or not the orbits of Hind and Peirce had reference to one and the same comet, and the result of his investigation appears to be in the affirmative, notwithstanding the opposite heliocentric motions attributed to the orbits.

1506.—D. u. Pingré stated that it had a long and brilliant tail. Its duration very uncertain: the accounts varying between 8 and 30 days or even more.—(P., v. 1, pp. 481-2.) It was as large as a ball! of a pale blue colour, and the tail from 3° to 5° in length.—(C. T., 1846, p. 54.) M. Laugier computed this orbit from the Chinese obs. of 31st July, reported by M. E. Biot, and those of 8th and 14th August given by Pingré. The geocentric arc was 70° and the middle obs. came out very well. He remarked the analogy between this comet and that of 1780 (2), whilst he admitted the discrepancy between the P. Ds.—(C. R., v. 22, p. 154)

Laugier remarked on these and other extracts from Pingré—"The obs. of the 8th August must have been made one or two hours before sunrise; the constellation Ursa Major was then in the North East, and

the comet, which might have had a L. of 121° , and a Northern l of 39° , was below the seven stars of that constellation, its tail in opposition to the sun, being in the direction of the north pole. He inferred the following positions:—

July 31.	L. 81°	l. $+42^\circ 40'$
August 8.	121	+39 0
14.	156	+22 0

from which his elements were deduced. He remarked a strong similarity between this orbit and that of 1780, and in reply to the objection which might be raised on the difference between the P. Ds., he stated that the obs. of 1506 may be represented tolerably by orbits with P. Ds., varying from 0.06 to 0.38"—(C. R., v. 22, p. 155.)

1531—D. u. Another apparition of the comet bearing the name of Halley, whose elements were computed from the obs. given by Appian.—(D, v. 3, p. 419.) The second orbit is taken from Olbers' Catalogue, the period deduced from it being 75 years. Appian's first obs. was on 13th August. It had a tail, but Pingré gave no description of it. He said that it first appeared on 1st August, or at the end of July.—(P, v. 1, pp. 487-9) M. E. Biot stated from the Chinese obs. that its train was about 7° in extent, and that the comet was visible for 34 days—(C. T., 1846, p. 54) For former supposed apparitions of this comet the reader must be referred to M. E. Biot's remarks thereon.

1532—D. u. The orbits have been calculated from Appian's obs. It was suspected that this comet might be the same as that of 1661, and that it should have returned in 1789. But, before this year, Méchain having re-reduced the obs. had almost demonstrated the contrary, and, therefore, that it should not be expected. In fact it did not return. Olbers having examined the question in 1787, concluded the orbit to be very similar to that given by Halley. Still he did not believe in the identity of the two.—(D, v. 3, p. 419.) In this year there appeared a comet which was again seen in 1661. Fracastor reported its head to have been three times the size of Jupiter, and its beard two fathoms long!! Its duration about 71 days.—(P., v. 1, p. 491.) Its tail was 1° long on 2nd September, which increased to 10° . It was visible altogether about 115 days.—(C. T., 1846, p. 55.) See note on 1661.

1533.—D. u. The two orbits taken from D. were computed from Appian's obs. The discrepancy between them proves the coarseness of the obs.—(D., v. 3, p. 419) This comet had a very long train, and its head was somewhat larger than Jupiter. Pingré conceived the orbit by Douwes to be very exact.—(P., v. 1, pp. 496-8.) On 1st July the length of the tail was about 5° , which increased subsequently

to 10° .—(C. T., 1846, p. 55) The tail extended to 15° on 21st July.—(A. J., 1800, p. 126.) See same for further details by Olbers.

1556.—D. u. Gemma asserted that this comet was at least as large as Jupiter, and with a tail of 4° . Its colour like that of Mars, which, however, afterwards became quite pale. Another eye-witness stated that the end of the tail was always of a leaden hue. Pingré was of opinion that this comet should be included in the number of those of whose period of revolution we are ignorant.—(P, v. 1, p. 502-7.) Its tail was about 1° in length on 1st March.—(C. T., 1846, p. 55.) Mr. Hind's first computation of the elements of this comet was not published. For his second attempt (the first set given in the Catalogue), he selected the obs. of 5th, 9th, and 14th March: and from the resulting elements he computed an ephemeris which agreed very well with the greater number of the comet's observed positions.—(A. N., No. 493.) His third set of elements was rejected in favour of the fourth. (The second set given in the Catalogue.) This was computed on ascertaining that the obs. of the 5th March, given by Pingré, was incorrect: a result arising from his consulting the chart of Fabricius given by Lycosthenes.—(A. N., No. 634) Perhaps under these circumstances, the first of the two orbits given might have been omitted. See note on 1844 (3.)

1558.—D. u. Orbit computed from three obs. by the Landgrave of Hesse and one by Gemma.—(A. J., 1817-176) This comet appeared on the 14th July, according to Mezerai. others, nearly unanimously, deferred the date to August. It was much fainter than that of 1556. There is an enormous difference between the obs. made by the Prince and Gemma on the 10th August, and Tycho thought that the error lay with the Prince.—(P, v. 1, p. 507-8) M. E. Biot does not notice this comet. On the whole there can be little confidence due to the elements.

1577.—D. u. This comet appeared in Japan about the 2nd November. It was discovered in Peru on 1st, and in Europe between the 10th and 12th. Tycho seems to have seen it first on the 13th, determined to watch its motion, with the precision of which he alone was capable, and commenced operations on that day. Pingré gave his obs. from which Halley calculated the elements. Tycho judged the diameter of the head to have been $7'$ and the length of the tail 22° on the day he first saw it; and that the tail was rather curved towards the form of the arc of a circle; that it was sometimes reddish at its root, and resembled a flame struggling to pierce through thick smoke.—(P, v. 1, pp. 511-519) Cassini considered the comet of 1680 to be the same as this.—(H. A., 1699.) Its colour was bluish white, and it (the tail of course) was about 10° in extent.—(C. T., 1846, p. 55.)

1580.—D. by Moestlin at Tübingen on the 2nd October, by Tycho and others on the 10th. Pingré gave voluminous details of it. On 10th October its light was feeble and livid, and the tail difficult to distinguish. On the 12th November the length was about 3° .—(P., v. 1, pp. 521–540.) Halley's elements were computed on the obs. of Moestlin, and those by Pingré on Tycho's. The elements of Pingré involve errors to the amount of from 10' to 12'. One may judge from this what may be expected from more ancient comets.—(D., v. 3, p. 419.) It lasted about 70 days.—(C. T., 1846, p. 56.)

1582.—D. u. This was the second comet that appeared this year. It was first seen in Europe at Grlitz and Uraniborg on the 12th May. The duration of apparition did not exceed 15 days. Its head scarcely equalled in brilliancy a star of 4th mag., and its train was about 3° in length on the 17th of same month. The orbit of a comet seen for so short a time cannot be considered to be very exact.—(P., v. 1, pp. 544–550.) The two orbits given are founded on four obs. by Tycho: the first appears to be the most probable.—(D., v. 3, p. 419.) The Chinese Annals, reported by M. E. Biot, stated that the tail resembled a long piece of silk!! and that the comet was visible for about 20 days.—(C. T., 1846, p. 56.)

1585.—D. apparently on 8th October, O. S. by the Landgrave of Hesse, and by Rothmann.—(P., v. 1, p. 552.) Halley's orbit is from Tycho's and Rothmann's obs.—(D., v. 3, p. 419.) These obs. were given by Pingré. During the earlier days of its visibility the comet equalled Jupiter in magnitude, but was less bright. It had neither beard nor tail. On the 30th October and 1st November, and on these days only, it emitted a ray very faint and difficult to discover.—(P., v. 1, p. 552.) M. M. Laugier and Mauvais affirmed that Halley's elements did not accord well with the obs., and substituted the ellipse in the Catalogue, giving a periodic time of 5 years 2 months. This appeared to them to place beyond all doubt the identity of this and the comet of 1844 (1). M. Leverrier asserted that an ellipse was not necessary to account for the obs., and he produced a parabola which answers equally well; stating that the greatest errors of the ellipse in L. and l. surpass those of the parabola. He also discussed the question of identity at great length, deciding in the negative.—(A. N., No. 624.) M. Schumacher made a long investigation into the orbit of this comet with his accustomed ability. The elements given in the Catalogue are the 4th set published by him. His remarks terminated thus:—"One is hence justified in coming to this conclusion, that neither Tycho's nor Rothmann's obs. admit of other than a parabolic orbit for this comet."—(A. N., Nos. 689–690.) Mr. Hind's elements have been published in the notices of the R. A. S. of England, in A. N., and in C. R.

He was of the opinion of M.M. Laugier and Mauvais, with reference to the identity of this comet with that of 1844 (1.)—(R. A. S. No. v. 7, No. 2.) The period by Mr. Hind's ellipse = $15\frac{1}{2}$ years—(v. 21, p. 1074) "When doctors disagree," &c. Those who would make themselves acquainted with the animated discussion between French astronomers, are respectfully referred to the C. R. for December 27th, 1847. The tail was about 1° in length—(C. T., 1846, p.

1590.—D. u. From the 5th to 17th March a comet of mean magnitude appeared. It had a great tail of about 4° or 5° in extent traversed daily 4° of a great circle. On the 5th it resembled a 2nd mag. at first, but on the same night it increased, appearing as a star of 1st mag., with a train 7° long—(P, v. 1, pp. 554–6.) It seems to be some error in one of the assertions as to its length of tail. M. E. Biot did not notice this comet. Halley's orbit calculated from Tycho's obs. Mr. Hind reduced these obs. from the account given by Pingré, and gave a number of geocentric longitudes. His parabola in the Catalogue was the result of a great many calculations, and, as he said, represented the obs. better than any of the other orbits. He added that the obs. extended over too short a period to be affected by too large errors, to give any hope of a successful result of an investigation into the nature of the conic section described by the comet.—(A. N., No. 584.)

1593.—D. by C. J. de Rissen, at Zerbst in Anhalt, on 20th March. On 4th August its colour was livid and reddish, and its tail about 1° in length, but on the 15th of same month there was little vestige of tail to be seen; and on 1st September none whatever. This comet was also seen in China.—(P, v. 1, pp. 557–60) The orbit given by Pingré is founded on rather rough obs. by John Ripensis, a pupil of Tycho (D, v. 3, p. 419) The remarks of M. l'Abbè de la Caille were first found in H. A., year 1747. The Chinese saw this comet for the first time on the same day that it was discovered in Europe.—(C. T., 1846, p. 56)

1596.—D. u. The light of this comet was pale: the head at first sight seemed pretty long, but after looking steadfastly at it for a short time, it appeared to vanish. These particulars were related by Santucci, and are termed "nonsense" by Pingré. Tycho reported on 24th July, its head equalled a star of 2nd mag., and that its train was 3 or 4 palms long! Pingré preferred Tycho's obs. to those of others, and supposed Halley to have been ignorant of them (P, v. 1, pp. 560–7.) Halley's orbit was computed from observations of Moestlin, and Pingré's, from Tycho's. Halley's elements differ from Tycho's obs.—(D., v. 3, p. 420) This comet is not noticed by Biot. M. Valz signalized some errors in the Cometograph.

Pingré, and said that on account of the uncertainty of the declination on the first day of obs., (July 27,) he sought an orbit to satisfy in L. only the obs. of that day. He recognised some similarity between this comet and that of 1845 (3).—(A. N., No. 551) See also C. R., v. 21, p. 965.

1607.—D. u. The third well ascertained apparition of Halley's comet. Obs. by Kepler, at Prague, Longomontanus, at Copenhagen, and Malmoe, in Scania. Pingré did not consider Halley's elements to be as satisfactory as some others he had computed—(P., v. 2, p. 3) Bessel's orbit was deduced from Harriott's obs.—(D., v. 3, p. 420.) Harriott's MSS. were found in England in 1784, and were given at length in the first Supp. to the Berlin Ephem., where it may be found that Harriott discovered it on 17th September, and stated that its train was nebulous. The second orbit by Halley is taken from Olbers' Catalogue, which was lent to the writer when on the continent, and no note is attached explanatory of the data made use of. The period, according to this orbit, is 76 years. The P. P. of Halley's parabolic elements is given in Pingré, for October 16, which is, probably, a misprint.

1618 (1).—D. u. First seen on 25th August, at Caschau, in Hungary; on the 27th, near Lintz, in Austria, and by Kepler, on 1st September. On the 6th of this month a slight extension of the coma was remarked. Pingré's elements were taken from his Catalogue, but he expresses little confidence in them.—(P., v. 2, p. 4.) There seems to be no other notice of this comet.

1618 (2).—D. u. Seen on 10th November, in Silesia and at Rome; also by the Spanish ambassador at Ispahan, who remarked that the tail was a sixth part of the zodiac in length. The Jesuits, at Rome, estimated the tail at 40° long on 18th November. Struyck did not believe in the existence of this comet.—(P., v. 2, p. 5.) Halley's orbit was from obs. made or collected by Kepler.—(D., v. 3, p. 420.) Bessel's elements were founded on Harriott's obs. He gave $16^\circ 20' 24''$ for length of tail, on 20th and 21st November. On 26th = $16^\circ 20'$. On December 1st = 40° , and on 8th = 20° , and said that it was curved. Kepler stated that this comet had the longest tail of any for 150 years. and that it reached its greatest length of 70° on 9th December. Cysati made it 75° ; and Longomontanus 104° !!—(A. J., Supp., v. 1, p. 27.)

1652.—D. u. This comet, of a pale, livid colour, almost equalled the moon in magnitude, according to Hevelius and Comiers. It was obs. by many astronomers from 18th December of this year to the first days of January, 1653. Almost all the obs. are pretty rough. Those by Hevelius, at Dantzic, were from 20th December to 8th January, and are certainly the best. During the 20 days he obs. it 16 times.—(P., v. 2, p. 9.) Cassini suspected the comet of 1698 to be identical

with this.—(H. A., 1699, p. 74.) The orbit was computed from the obs. of Hevelius.—(D., v. 3, p. 420)

1661.—D. u. Pingré referred his readers to the *Machina Cœlestis* for Hevelius's obs. from the 3rd to the 28th of February, or rather to the 10th March. He added, that there was no room to doubt, that this comet and that of 1532 were identical.—(P., v. 2, p. 10) Eberhard Welper's obs., at Strasburgh, are inserted in A. J., 1788, p. 195. He stated, that on 29th January, O. S., the tail was 5° long. In A. J., 1790, may be found Bode's remarks upon this comet, and that discovered by Méchain in 1787, wherein he opposes the notion of their identity, although from the earliest apparent position of the 1787 comet, he had suspected that they might be the same. Halley's elements were computed from the obs. by Hevelius.—(D., v. 3, p. 420) On the supposition of Pingré this comet should have re-appeared about 1790, but none that were seen about that period can be identified with it.

1664.—D. u. It is said that this comet was seen on the 17th November, in Spain. Huyghens obs. it for the first time on the 2nd December. Hevelius began to obs. it on the 14th, and concluded his work on 14th February, 1665. Others obs. it up to 17th or 18th March. An obs. given by Hevelius, for 18th February, gave rise to a sharp interchange of correspondence between him and Auzout. Pingré's opinion was decidedly unfavourable to Hevelius, and Halley's orbit, agreeing well with others, is irreconcilable with his obs. of 18th February. The obs., by an anonymous writer, are given in full by Pingré. His first appears to have been made on 18th December, 1664.—(P., v. 2, pp. 10-22) For obs. by Auzout and Buot, see M. A., 1666-9, v. 10. The Rev John Ray, supposed to have been in Rome at the time, made the following obs. :—"On December 20th, 1664, N. S., about 3 o'clock, A. M., I observed the comet; it was in the constellation of Hydra, not far from the foot of Crater. It appeared about the size of a star of the first magnitude, but not near so lucid and bright. It had a very long tail, which pointed almost directly towards the heart of Hydra; the tail showed somewhat like rays of a candle burning in a mist; its figure was conical; its length 5° or 6°, the breadth at the base not above a degree and a half. The body of this comet was about 3° to the S. E. of the most Southerly Star in the foot of Crater; it stood very nearly in a right line with the two lowermost stars in the foot of Crater, which are common to it and Hydra. December 21st, at about the same time, it was removed about a degree and a half more westward, and a little to the S; the tail pointing still towards the heart of Hydra, and appeared at the least 10° long. December 22nd, at the same hour, it was removed in the same direction, and about the same distance as the night before. Its tail still pointed to Cor Hydræ, or a little above it, as

the two former days, and was rather longer than shorter. I thought it also appeared brighter and larger, its body being larger than any fixed star, except Sirius. December 23rd it was removed still in the same direction, and about the same distance as the day before; the comet brighter, the tail as long as ever, and pointed almost directly to Cor Hydræ. December 24th, 25th, 26th, all these three nights were cloudy, so that I could make no obs. December 27th we found it strangely removed from the place where it was: but it was still westward, and a little to the S, as before. The body of the star was still brighter, and the cauda about it greater, and more bushy, and yet as long as before; it pointed almost directly against Canis Major. Its body was among the stars of Argo. December 28th, at the same time, it was removed above 2° towards the same point, and came within 4° or 5° of the most eastern stars in the bright triangle in the hips of Canis Major. The moon shining, we could not so well judge, either of the size of the body, or the length and bushiness of the tail. December 29th, it was strangely removed, and got before, not the eastern star only of the bright triangle, but also the most northern. I think, at least, in this last 24 hours, it had moved 4° . The moon shining bright, the tail could not be well observed, yet still it seemed to point directly to Canis Minor."—(P. T. Ab., v. 5, pp. 333-4.) Halley's orbit was computed from the obs. of an anonymous Spaniard, published by Pingré.—(D., v. 3, p. 420.)

1665.—D. u. Seen at Aix on 27th March. Hevelius obs. it with great care from 6th to 20th April. Auzout and Petit at Paris —(P., v. 2, p. 22) The elements were calculated from the obs. by Hevelius. —(D., v. 3, p. 420.) See note on comet 1672. J. D. Cassini said: "Concerning the new comet you mention, I saw it on the 11th of Feb., about the 24th degree of Aries, with a N. latitude of $24^\circ 40'$. The cloudy weather has not yet permitted me to see it in Andromeda, as others affirm to have done."—(P. T. Ab., v. 1, p. 9.) M. Auzout stated, that both the body and train of this latter (1665) were much more bright and vivid than the former (1664).—(P. T., v. 1, p. 14.) "J. Hevelius, in his work entitled 'Descriptio Cometæ, A. D. 1665, and obs. Cometæ, 1654,' gives an account of that of 1665 which appeared when the other was scarce extinct, adding a fair delineation of its course, with the genuine representations of its head and train, in each day of its appearing; and subjoining a general description of some of its more remarkable phenomena." "The head of it is in the book described of a colour like that of Jupiter, all along much brighter than that of the former comet, though of a somewhat less magnitude; having in its middle only one round, but very bright and large kernel, or speck, resplendent like gold, and encompassed with another more dilute and

seemingly uniform matter: its tail being at first about 17° , and afterwards 20° , and sometimes 25° long, and divaricated towards the end, which became narrower and more attenuated as it approached towards the sun."—(P. T. Ab., v. 1, pp. 115-6.)

1668.—D. uncertain. This comet was seen only in Southern countries. Cassini saw its tail at Bologna on 10th March, an hour after sunset; it extended from Cetus to the middle of Eridanus. He also saw it on the following days. Montanari, too, remarked this tail, the head being plunged in the rays of the sun. It was seen at Lisbon on 5th March, and on the same day also by P. Valentin Estancel, in the Brazil, a little above the horizon, in the west; it was 23° long, the head being small and difficult to discern. On the 8th, 10th, and 11th March, it advanced to Lepus and Eridanus. The portion of the tail seen at Lisbon was 45° in length. Cassini estimated it at 30° or more.—(P., v. 2, pp 22-3.) Mr. Henderson deduced the obs. places of this comet, from a map in his possession, representing its apparent track among the stars, from 9th to 21st March, obs. at Goa in India. In 1842 he communicated to M. Encke the first orbit given in the Catalogue. After the appearance of the great comet 1843 (1) he computed the second set of elements. His own words are here given:—"I was engaged in an attempt to reconcile the obs. of the one first in date with the orbit of the latter, when I received the second circular, (M. Schumacher's,) and, following in the steps there pointed out, I have assumed the following elements in 1668, taken, excepting the time, from some of the recent obs., P. P.=1668, Feb 28.8 G. M. T Log. P. D=7.68; L P= $277^\circ 2'$, L. N= $357^\circ 17'$, I= $35^\circ 58'$, Motion R." From these elements Mr. Henderson computed the places, and compared them with the obs. and concludes thus:—"The differences between the obs. and computed places from 9th to 17th (March) inclusive, may perhaps be diminished by a better determination of obs. places from the map, and a better assumption of elements. The great differences from 18th to 21st are evidently owing to the uncertainty of the obs., and they may be accounted for on the supposition that the nucleus was then invisible."—(A. N., No 476.) M. Paravey reported to the French Academy a passage from "La Relation des Missions des évêques Français aux Royaumes de Siam, de Cochinchine," &c., in which it is stated, that, on the 8th March, 1668, a comet was seen at Tonquin, in the constellation of Orion, near the star in the left foot. On 16th the phenomenon, *situated in the same place*, had lost some of its brilliancy. The orbit of the Tonquin comet has not been computed. It is not even certain that the object was the same as that seen about the same date in Europe.—(C. R., v. 4, p. 589) "The Italian account given by G. D. Cassini, Anno 1668, the 10th of March, one hour of the following night, (after

the Italian way of counting,) at Bononia, S. Cassini obs. a path of light extended from the Whale through Eridanus, which he judged to be the train of a comet, both by the figure and colour, as also that the direction of it, being by the fancy continued, seemed to proceed to the 21st degree of Pisces, where the Sun then was, and so tended to the part opposite to the Sun, like other comets. By its extreme point reached to that star in Eridanus marked 14 by Bayer, but it issued out of the horizontal clouds, so that it seemed the head of the comet was either veiled by them, or hid under the horizon. It followed the motion of diurnal revolution westward, and it was to be seen about the second hour of the night; for then it was demersed in the mists of the horizon. March 11th, in the evening, the horizon was, in the west, overcast with thin clouds, among which, after one hour of the night, there was seen a brightness in the Whale, at least for half an hour, which was very like the splendour of Venus, likewise veiled by thin clouds. March 12th, at night, the lower parts of the heavens in the west were clouded, and when the great Dog Star was in the mid heaven, the same tail appeared again; it passed through the star in Eridanus, which Bayer calls the 15th, and left to the southward the 14th, where it terminated March 10th; being, by the imagination, drawn out to about 3°, and further, it tended to the Southern Star which precedes the ear of Lepus. It was therefore more northerly than the day before yesterday, and more easterly, and it also reached to the opposite part of the Sun. The apparent part of the train reached out in length about 32°. So far the Italian relation. The following is that from Lisbon: March 5th, N.S., forasmuch as it seems to follow the regular course of the Sun, and sets few hours after it, there could hitherto be taken no considerable obs of it. The body is not seen, because it remains hid in the horizon. Its train is of a stupendous length, extended in appearance over almost the fourth part of the visible heaven, from W. to E., its apparent breadth is of a good palm, and its splendour very great, but it lasts only a few hours. Several letters written from France also mention its having been seen in several parts of that kingdom, as at Lyons, Toulouse, Toulon, but not at Paris, no more than it hath been obs. at London, nor in any other part of England yet heard of."—(P. T. Ab., v. 1, pp. 250-1.) See also P. T. Ab., v. 2, pp. 135-6. See Note on 1843 (1.)

1672.—D. by Hevelius, at Dantzic, on 2nd March. The Jesuits de la Flèche also found it on the 16th. The obs. by Hevelius were made from 6th March to 21st April.—(P., v. 2, p. 23.) Cassini commenced obs on 26th March, and saw it until 7th April. He compared it with the second comet of 1665, of which he had published a theory at Rome; and found that both, with some little exception, had followed the same path through the heavens.—(H. A., 1666-1686.) It can scarcely be

maintained that the orbit of this comet, by Halley, bears sufficient resemblance to that of the comet of 1665, computed by the same astronomer. Pingré reported the assertions made of the appearance of two others this year, but disposed of that said to have been seen at Rome by stating that the object was the Nebula in Andromeda, and of the other, on the authority of Hevelius, that it was a group of stars. M. Richer saw this comet in Andromeda, on 15th March, 1672 — (M. A., 1666–1699, v. 7, part 1.) The obs. by Cassini may be found in the M. A., 1666–1699, v. 10. He said that the nucleus appeared round, but not well defined or distinguished from the nebosity. A tail was almost imperceptible; nevertheless in a telescope it appeared on the side opposite to that of the Sun, and of the length of about two diameters of the head. The entire phenomenon did not exceed 3' or 4'. Halley's orbit was calculated from the obs. by Hevelius — (D., v., 3, p. 420.) In Pingré the L. P. is printed by mistake = 9 848476. Extract of a letter from M. Hevelius, of March 9, 1672 :—"There has been seen here a new comet from 2nd March, 1672, which I myself, being some days absent from home and from my instruments, could not observe till March 6th, in the evening. It is seen both morning and evening. It is but small, having at present a train not above 1° or $1\frac{1}{2}^{\circ}$ long, which would doubtless appear larger if it were not for the twilight and the presence of the moon. It is now about the stars in the right arm of Andromeda, on her shoulder blade." "We (P. T.) have since been informed by Mr. Isaac Newton, that about the 16th March, 1671 O. S., he saw, at night, a dull star, south-west of Perseus, which, he says, he now takes to have been that comet of which we gave him information. But he adds that it was very small, and had not any visible tail, which made him regard it no farther; so that he fears that it will now be difficult to find it."—(P. T. Ab., v. 1, p. 696.

1677.—D. by Hevelius, at Dantzic, on 27th April. He obs. it for 10 days consecutively. This comet was also obs. at Greenwich, Paris, &c — (P., v. 2, p. 24.) It was at its least distance from the earth on 20th April, and at that time moved over 15° daily. M. Cassini received the obs. made at Madrid, and compared them with his own. This comet passed between Triangula and Caput Medusæ, and Cassini, on a retrospect of 100 years, found eight others which had passed through the same, or very nearly the same portion of the heavens. He remarked the advent of a comet in 1572 and of another in 1672 : of one in 1577, and another this year; and asked, "May not these four comets be reduced to two?" It would be almost certain if there should be re-appearances in 1772 and 1777 in nearly the same positions in space; for being found *nearly* so would suffice.—(H. A., 1666–1686.) We have no orbit of the comet of 1572, so can institute

no comparison between it and that of 1672. The elements of the comets of 1577 and 1677 differ enormously in the node. A comet did appear in 1772, but its I was about 19° , whereas that of the comet of 1672 was 83° . No comet appeared between 1774 and 1779. The Madrid obs. are in the *M. A.*, 1666–1699, v. 10, as also the hypotheses of Cassini. The orbit given was founded on the obs. of Hevelius.—(*D*, v. 3, p. 420) The two last figures of P. D. are inverted in Pingré, and P.P., by Halley in *Misc. Curios.* in April 26th, $0^h 37\frac{1}{2}^m$. Cassini stated that “Mr. Romer first observed the new comet, April 28th, N.S., 1677.” “The magnitude of its head, seen through the telescope, was almost equal to the disc of Jupiter, or somewhat less. It did not appear perfectly round, but of an oval figure; the longer diameter being parallel to the horizon; which seemed to be owing to the horizontal refraction. Its coma, seen through the telescope, was broad, and nearly parabolical, but to the naked eye it seemed narrow and a little inflected towards the West.” From the statement by M. Hevelius, the following is extracted:—“Its head was not large, but yet bright, consisting of one shining nucleus, like that of the year 1665. It stretched out a tail pretty luminous, with divaricating rays turned upwards near 2° in length. The line of direction of the tail produced, passed Almac, the bright foot of Andromeda, and her girdle, bisecting the distance between these two stars.” “April 30th, it spread its tail again 2° or more to the N. Star, in the base of the triangle, which star could plainly be seen with good tubes at the end of the tail. May 1st, at $2^h 32^m$ in the morning its tail was yet pretty bright, but a little shorter though broader, which it stretched out to the bright foot of Andromeda. May 2d, at $8^h 45^m$ in the evening, on account of the twilight, the tail appeared very thin, which was extended between the knees of Cassiopeia, but nearer to the left. May 3d, at $1^h 23^m$ in the morning, the comet rose, though we saw the tail a little sooner—viz, at $1^h 18^m$. This day the tail was longer, extending near 3° , very bright and well defined. Thus we saw it with the naked eyes at $3^h 34^m$ and with the telescope at $3^h 40^m$, so that the Sun at that time was depressed only 6° below the horizon, and we had seen it longer but for some small intervening clouds. On May 4th, in the evening, the air being very pure, at $8^h 53^m$ the comet was seen, but a little obscurer than the former days, and the tail shorter. On May 5th at $1^h 41^m$ in the morning, it was seen with the tail directed towards the right knee of Cassiopeia. May 6th, in the morning, the head seemed thinner and weaker than the tail, as the Sun was only about $16\frac{1}{2}^\circ$ distant. In the evening of the same day it was seen with the optic tube at $8^h 35^m$, with the tail shorter and thinner; but its situation below, and the twilight strong, the comet could not be seen with the naked eye. May 8th, from 1 o'clock

in the morning it was sought for in vain with the naked eye, but was discovered with the 12 foot telescope, having still a tail, though very short, extending a little to the left hand from the vertical circle. May 8th, in the evening, the comet could no longer be seen, either with the naked eye, or with any telescope, nor yet on any days afterwards." Mr Flamsteed stated, that at about 2 o'clock, A.M., of April 23, he saw the tail raised almost perpendicular to the horizon: soon after the head appeared through a thin vapour, from which the tail pointed, as near as he could guess, on the star on the knee of Cassiopeia, its length being about 6° , and breadth at the top about $7'$ or $8'$. Viewing the head with a telescope of 16 feet, he found it was not perfectly round, but indented, and not near $1'$ diameter. On the night of the same day, at about $2^h 45^m$ A.M., (24th,) he saw its tail which appeared much shorter than the preceding morning, through a break of the clouds, which, soon after opening wider, he saw the head too.—(P. T. Ab., v. 2. pp. 390-4) .

1678.—D. by de la Hire on 11th September, and was visible until 7th October. The orbit was calculated by the desire of Struyck, and on the supposition that all the obs. were made at 10 P.M., M. T., Paris — (P., v. 2, p. 24.) Delambre calls de la Hire's obs., from which the orbit was deduced, very rough.—(v. 3, p. 420.) In the H. A., 1666-1686, it is stated that a small comet appeared in Sagittarius. See Note on 1844 (1.)

1680 —D. by an unnamed person at Coburg, in Saxony, on the morning of the 4th November, O. S. On the 11th the tail was half a degree long; and on 17th = 15° . It subsequently reached to 60° , and was seen for the last time on the 9th March, 1681, O. S. —(Struyck, p. 270.) It was also discovered by Godefroï Kirch, on 14th November. Pingré calls it a great and celebrated comet. Hevelius saw it first, on 2d December. He suspected its re-appearance after its conjunction with the Sun, and saw it again on the evening of the 14th, watching it until 17th February, 1681. He could not obs. it accurately, as fire had destroyed his observatory and its contents. Flamsteed perceived the tail on the evening of 20th December, and the head on the 22d, and obs. it on that day, continuing so to do until 15th February following. Halley computed his two orbits from the first obs. by Kirch, those by Flamsteed, and two by Newton made on 11th and 19th March, 1681. Newton's orbit was obtained from graphical operations, rather than from rigorous calculation. He only gave it as approximate; but Pingré remarked that the result was a proof of what might be done by compass and rule in the hands of such a man as Newton.—(P., v. 2, pp. 25-8.) Of all comets this is the one which approached nearest to the Sun. The ellipse by Halley gives a period of 575 years; that by

Euler of $170\frac{1}{2}$ years; that by Pingré of 15,864 years. The two last periods are deduced from the obs. One may see by this example what may be thought of ellipses computed from a small arc — (D., v. 3, p. 420) It may be, however, now questioned, whether or not the 1843 (1) approached still nearer to the Sun. The eccentricity given for Halley's ellipse was deduced by Mr. Graham from the major axis printed in Newton's Principia. In the A. J., 1822, p. 258. there is allusion made to a very interesting article on this comet, which appeared in "Die Zeitschrift für Astronomie," &c, in July, August, September, and October, 1818, and which the editor of A. J. thought to be by Profr. Encke. There can be little doubt that the two orbits by Encke in Olbers' Catalogue were the results of the investigation recorded in that article. He remarks that the periodic time of this comet cannot be taken under 2,000 years, and that Newton found (as already stated) 575 years. In fact, Encke's elliptic orbit gives 8,814 years. For a most interesting paper, by Mr. Hind, on the supposed period of revolution of this comet, see R. A. S. Notices, v. 12, p. 142. His conclusion is adverse to the Halleian period of 575 years. See also P. T. Ab., v. 6, pp. 114–15. M. P. J. de Fontenay, in a tract on this comet (Paris, 1681, Philos. Collect., No. 4, p. 106), says, that on December 16th, 1680, in the evening, the length of its tail was about 70° , its breadth in the middle about 2° , and at the upper end about 3° , full like a rainbow, reddish, and a little bended toward the west, it passed through the Eagle, the Dart, and the left wing of the Swan, covering the Southern Star, in the neck of the Eagle. The 17th, about 5 in the evening, he discovered the head, of the size of a star of the first magnitude, among those of Antinous. He now viewed the head with a 12 foot telescope, and saw it differing both from stars and planets, being a dusky light like a cloud, about the size of the moon, and brighter in the middle than the extremes. He naturally enough concludes that it was neither a planet nor a cluster. — (P. T. Ab., v. 2, p. 523.)

1682 — D. u. The fourth well-ascertained apparition of Halley's comet. Picard and de la Hire obs. it at Paris on 26th August. Hevelius saw it for the last time on 17th September. — (P., v. 2, p. 28.) A micrometrical measure of its head, with a telescope of 16 feet, gave about $2'$ (H. A., 1666–1686.) The verification of Halley's prediction of its return in 1759 occupies considerable space in the H. A. for 1759, in two different places. One paper was by M. de l'Isle. The history of this comet is so well known, even to amateurs, that further remarks would be supererogatory. The two orbits by Halley were computed from Flamsteed's obs. — (D., v. 3, p. 420) In the I. of Halley's first elements, as found in Delambre, there is an evident misprint of $16^\circ 56'$ instead of $17^\circ 56'$. The first orbit, by Rosenberger, resulted from a very careful examination of the obs. of

1682: the second, from the obs. of 1782, combined with those M. Hevelius stated that the comet was first seen at Dantzic on 25th, N.S., and that he obs. it from that time to September 7th. to its appearance, the head was rather brighter and larger than the year 1681, but, that on the other hand, it had a much shorter tail. That, with a long telescope, there could be observed in the head one nucleus, and that always of an oval and gibbous figure that on September 8th, especially, a very bright ray proceeded from the nucleus, which was rather crooked, and passed into the tail. This, said, was the more remarkable, as he did not remember to have seen the like appearance in any other comet. Its coma was also of great lengths: for, at first, the tail was about 12° long; afterwards shorter, and sometimes longer, as far as to 15° or 16°; but towards the end, it diminished continually.

1683.—D. u. Hevelius obs. it at Dantzic from 30th June to 5th September; Flamsteed, at Greenwich, from 23rd July to 5th September.—(P., v. 2, p. 28.) The nucleus was not larger than 4th mag. The tail was 3° or 4° long.—(Struyck, p. 284.) The orbit was calculated from the obs. of Flamsteed.—(D., v. 3.) Clausen's orbit was computed from the same data.—(A. N., v. 3.) In Pingré, the last figure of Log P. D. is 7. The period, by his orbit, = 190 years. M. Hevelius's account, as to its physical appearance, was, that as to the head of this comet, its diameter at first was much greater than afterwards; but, on the other hand, it was much brighter towards the end. It exhibited no distinct and fulgent nucleus, but appeared a confused mass of matter which became much more distinct towards the conclusion. As it was seen mostly without a tail, it cannot be numbered among the hairy comets, for it extended upwards only a short and diluted bristles only till August 18th, which afterwards disappeared.—(P. T. Ab., v. 2, p. 683.)

1684.—D., it would seem, by Bianchini. The orbit was calculated from his obs. They were made from the 1st to 17th July.—(P., v. 2, p. 420.) Pingré was not aware that any other were made, and Struyck nor he gave any further information upon this comet. It is extracted from a letter from Signor Ciampini to Dr. Croone:—“This comet has lately been discovered at Rome by the Abbot Bianchini, a disciple of G. Montanari. It appeared but small, but regular in its orbit, of a thin light, and like a faint star. But, through its being so near the sun, it was more luminous.”—(P. T. Ab., v. 3, p. 135.)

1686.—D. u. Near Para, in the Brazils, a comet was seen the whole month of August. The head equalled stars of 1st magnitude, the train was 18° in length. It was seen on the 15th of this month at Amboyna, a little south of the girdle of Orion. On the 16th it was seen at Siam, with a train of 15°. There were four gr

it made by P. Richaud, at Pau, on 7th, 9th, 10th, and 15th September.—(P., v. 2, pp 28-9) The Siam obs are in M. A., 1666-1699, v. 7, pt. 2, p. 637, but are not interesting. Orbit rather doubtful, having been computed on an arc of 10° .—(D., v. 3, p 421.) This comet was obs., at Leipsic, by Mr. Kirch, in whose ephemerides for this year there is likewise a brief account of it. He saw it only twice, viz. on the 8th and 9th of September, O.S., and obs. it as follows: September 8th, 4^h A.M., about daybreak, he found the comet in the constellation of Leo, to the right hand of the Lucida in Lumbis Leonis, and resembling that star in colour and magnitude, with a thin and short tail extended upwards. This comet was seen by a countryman, who first gave notice thereof, from the 6th to the 12th of September.—(P. T. Ab., v. 3, p. 346.)

1689.—D., apparently, by P. Richaud, at Pondicherry —(P., v. 2, p 30.) This comet was not seen in Europe. At Pekin the tail only visible between 11th and 15th December. So much as was obs. was from 10° to 12° long. At Ternata the tail was seen $35\frac{1}{2}^\circ$ in extent on 11th December, 45° on 14th, 47° on 15th, $47\frac{1}{2}^\circ$ on 18th, and 60° on 22nd. It occupied $2\frac{1}{2}$ hours in rising. These details are from extracts from the log of a Dutch vessel, made by Struyck. P. Richaud obs. this comet at Pondicherry, and his remarks were given by Pingré. De Bèze and Comille saw it at Malacca. Its greatest apparent daily motion was from 14th to 15th December, and was a little more than 3° . They compared the tail to a great sabre, and said that it reached 68° in length. The orbit, by Pingré, was computed with a view to possible identification with some other appearance, but he had little reliance on the obs. on which he founded it.—(P., v. 2, pp. 29-33.) The obs. of P. Richaud and Comille are given in M. A., 1666-1699, v. 7, pt. 2, p. 819. Professor B. Peirce re-computed the obs. used by Pingré, and thence deduced his elements —(A. N., No. 480) See note on 1843 (1).

1695 —D. by P. Jacob, in the Brazils, on 28th October This comet was obs. with even less accuracy than the preceding. Its atmosphere entirely concealed the nucleus. The utter want of confidence in the obs. of P. Noel, declared by Pingré, should perhaps induce silence regarding them. It may, however, be stated that, according to this author, the tail of this comet varied in length from 15° to 40° .—(P., v. 2, pp. 33-5.) The orbit given was calculated on obs. recorded in MSS. left by de l'Isle, and now in the Paris Observatory.—(D., v. 3, p. 421.) Several remarks on this comet may be found in the M. A., 1702, and reported by Cassini.

1698 —D. uncertain. Not larger than a star of 3rd mag. La Hire spoke of a short tail.—(Struyck, p 289.) This comet was seen only at Paris. Cassini discovered it in Cassiopeia at the beginning of September, and la Hire obs. it from the 2nd to the 28th.—(P., v. 2, p. 36)

On the 2nd September la Hire discovered it. It had the appearance of a nebulous star like that in the girdle of Andromeda: its head very small, and tail very short. It was in perigee between the 7th and 8th September, and then appeared like a star of 2nd mag. Cassini compared the motion of this comet with that of the comet he had obs in 1652, and considered them to be identical.—(H. A., 1686–1699, p 341.) La Hire's obs are to be found in M. A., 1666–1669, v. 10, p. 742. The orbit given was computed from rather rough obs. by Cassini and la Hire.—(D., v. 3, p. 421.) See note on 1702 (2).

1699—D, apparently, by P. de Fontenay. It was obs by him at Pekin, from 17th to 26th February, and at Paris from 20th February to evening of 2nd March. This was the first of two comets which appeared this year.—(P, v 2, p. 36.) It passed through 7° daily.—(Struyck, p 290.) A map of the route of this comet, as observed at Paris, is introduced into the M. A., 1701, and the Pekin obs. are given at p 49. The orbit given was founded on obs. by Cassini and Maraldi.—(D., v. 3, p. 421.) Log P. D., according to Pingré, = 9.877573. Lalande agreed with Pingré. Delambre gave it as = 9 871570 M. Cassini stated, that on the night of February 19th, at the Royal Observatory at Paris, there began to appear through the opening of the clouds, which for some days had obscured the heavens, a small comet, like a nebulous star of the 3rd mag., like that which was obs. September, 1698. It was situated among the unformed stars of the 6th mag., near the N. polar circle, over the head of Aniga. By repeated obs. from that night to the next following, the comet appeared to have a proper motion, and to direct its course towards Capella, with little or no deviation from its circle of declination; so that, had not the sky been obscured the preceding days, it might have been seen near the N. pole.—(P. T. Ab., v. 4, pp. 354–5.)

1701.—D. by P. Pallu, at Pau, on 28th October. He obs. it same night, on 31st, and on 1st November. Its apparent motion was about 40 minutes (of space, surely,) daily. A tail was scarcely discernible.—(P, v. 2, p 37.) In a note by de Zach, is the following.—“The Jesuit, P. Pallu, obs it, (on the days stated,) as he announced to la Hire, but the obs. were never published, and were supposed to have been lost. In 1749 something was published on this comet, in the Latin Almanac of Berlin, for that year. Struyck, of Amsterdam, was desirous of calculating the orbit from the information thus given; but Euler, in a letter dated 11th January, 1749, gave him notice that all that had been said on this comet, in the almanac, was pure invention. The three obs., by Pallu, were subsequently found among the papers of the late M. de l'Isle. They consisted of diagrams, with the stars. The author of the bad joke, in the almanac, is unknown.”—(Z. C.,

v. 4, p. 470.) The elements were computed from the obs. by P. Pallu, which consisted of lines reduced by a method peculiar to the calculator. He suspected an error of 20° in I .—(D., v. 3, p. 421)

1702 —D. u. The elements given in the Catalogue appertain to the *second* comet of this year, the first being that which has been supposed to be identical with 1843 (1). This comet appeared on 20th April, and continued visible until 5th May. It was observed at Paris, by la Hire; and at Rome, by Maraldi and Bianchini, at Berlin, by Kirch and Hoffmann. L'Abbé de la Caille's orbit did not please Struyck, as he finds fault, and justly so, with the obs. Pingré considered those of Rome to be the best, and that la Caille's orbit might be adopted as approximative and useful to identify any return.—(P, v. 2, p. 38.) Bianchini's obs. are recorded in M. A., 1702, p. 118. He stated, that, on the 20th April, it resembled a nebulous star. Cassini's remarks are inserted in the same vol., p. 121. Herein he said, that Maraldi compared this comet with that of 1664, whose orbit crossed the ecliptic in nearly the same place as this, with little difference of I . between them, and with a velocity at its perigee approaching to that of this comet. La Hire fancied that this and the 1698 comet might be identical, and gave a map of both their routes—(M. A., 1702, p. 113, &c.) Burckhardt's orbit was computed to ascertain if this comet might not be the same as that of 1770, but the conjecture was void of foundation—(D., v. 3, p. 421)

1706 —D., apparently, by Cassini and Maraldi, on 18th March. Obs. at Paris, from this date to 16th April. Among the Parisian obs. are six made by comparison with stars of the British Catalogue. The second of these, corrected by the registries of the Academy, was forwarded to Struyck by la Caille, and the former rigorously reduced the remaining five.—(P, v. 2, p. 39.) The comet was near Corona Borealis when discovered by Cassini and Maraldi. It had the appearance of a small nebulous star. There was a comet in 1580 which had the same velocity, and followed nearly the same path.—(H. A., 1706, p. 104.) Cassini's and Maraldi's obs. are to be found in M. A., 1706, pp. 91 and 148, with a map of the path annexed. La Caille computed from obs. by Cassini and Maraldi. Struyck's orbit was founded on other obs. sent him by la Caille.—(D., v. 3, p. 421.)

1707.—D., apparently, by Stancari and Manfredi on 25th November. This comet was obs. at Paris, by Cassini and Maraldi, from 29th November to 25th December, at Bologna, by Manfredi and Stancari, from 25th November to 23rd January, 1708. Struyck's orbit was principally founded on four obs., corrected by la Caille himself. That of 25th November by him, is, according to Struyck, faulty; inasmuch as 10 minutes should be added to the declination, and 5 minutes to the

right ascension, given in the M. A. If, therefore, la Caille adopted the Italian obs. of the 25th November, in his calculation, his orbit should be less accurate than that of Struyck. Struyck remarked that this comet would have passed very near the earth, at the end of October, had it passed the perihelion 14 days earlier.—(P, v 2, p. 40.) It was detected by Cassini and Maraldi on 20th November. With the naked eye it was like a 2nd mag star. In a telescope of 12 feet focal length, it appeared to be surrounded by a nebosity, but without tail.—(H. A., 1707, p. 103.) The obs. made at Paris are given in M. A., 1707, p. 558, together with a map of its path. Those made at Bologna are to be found in the same work—1708, p. 323. The only remark which seems to be interesting is, that the nucleus (head?) was not round, nor of a regular shape, but appeared *indented* (?) in different places, whether this was caused by a collection of several small bodies, slightly distant from one another, or that there were spots on its surface! The orbits were computed from the obs. of Stancari, Manfredi, Cassini, and Maraldi—(D., v. 3, p. 421.) See note on comet 1723.

1718.—D. by Kirch on 18th January, and observed by him from this date to 5th February. Pingré had little confidence in the orbits of la Caille and Douwes, as he objected to the obs. themselves. He said that the instruments used were too small; that the positions were referred to places of stars in the Catalogues of Tycho and Hevelius; and that Kirch reduced all these places to 10 P.M., instead of giving the times of obs.—(P, v. 2, p. 41, D, v. 3, p. 421.) When Kirch first saw the comet it was next the right of Bayer's γ and β in the Ursa Minor, and appeared to the naked eye much brighter than β , though a remarkable star of the 2nd mag., and though much paler, yet of a larger diameter, and pretty bright, especially about its centre. When seen through the telescope, it appeared like a bright round nubecula; but no signs of a tail could be observed, nor could the nucleus be distinguished. On the 21st January, it did not seem to the naked eye to exceed a star of the 4th mag.; its diameter, by the telescope, was 7'. January 23rd, its diameter was 5', and to the naked eye it appeared like a star of the 5th mag.—(P. T. Ab., v. 6, p. 363.) Kirch thought its period to be 81 years, and that it was identical with the comets of 1471 and 1556.—(Struyck, p. 295.) Pingré and Lalande agree as to the L. N., (in Delambre it is printed $127^{\circ} 55' 30''$.) of Douwes's orbit. The P. P. of Whiston's orbit is given by Delambre, as January 15. 3185; and Olbers gave it as in the Catalogue.

1723.—D. u. Its tail was three spans long! on the 1st October; on the 9th, it was 1° in length.—(Struyck, p. 296.) This comet was seen at Bombay on 12th October, and 4 days later, at Lisbon. Halley, Pound, and Graham, obs. it, with the greatest accuracy, from 20th

October to 18th December. Struyck compared the obs. with the places calculated from Bradley's orbit, and a more perfect agreement cannot be desired.—(P., v. 2, p. 42) A white central light, pretty bright, with a great coma or nebulosity, less and less dense in proportion to the distance from the head. Maraldi saw a small star through it, and almost touching the centre. It may be seen that there are some points of resemblance between this, and that of 1707, to induce us to suppose that it may be the same comet, returned to us after 16 years. (H. A., 1723, p. 73) Cassini believed this comet to be the same as that of 1707.—(M. A., 1725, p. 173.) Maraldi's obs. are recorded in M. A., 1724, p. 365. Bradley's orbit was computed from his own obs. and those of the above-named British astronomers.—(D., v. 3, p. 421.) We have no note of the foundation of Burckhardt's or Spörer's elements, and omit those by Struyck, although given by Delambre, in consequence of Pingré's remarks upon them. This small comet was first obs. in England by Dr. Halley, Oct. 9th, between 7 and 8 o'clock in the evening, it appearing then to the naked eye not much unlike a star of the 3rd mag. The nucleus of this comet was very little, for it appeared but of a small diameter when first seen, though it was then above three times nearer to the earth than the Sun is at his mean distance. Its tail was then hardly discernible with the naked eye, but through a telescope one might perceive a faint light, extending itself above a degree from the body—(P. T. Ab., v. 7, pp. 13-15) Mr. William Saunderson stated that, at Bombay, in the month of October, this comet looked at first only like one of the white spots called the Magellanic clouds, the space filling the field of a six-foot glass. Afterwards he saw the head in the centre of the illuminated space, which did not look with much brightness, but appeared largest on the 10th October, decreasing gradually, both in its bulk and motion, from that time until the 25th, at which time he could find no appearance of it with the fore-mentioned glass.—(P. T. Ab., v. 7, p. 176.)

1729.—D. by P. Sarabat, at Nîmes, on 31st July. This comet is that of all up to 1780, which was seen at the greatest distance from the sun and earth, and is also one of those seen for the longest period. Douwes's orbit was computed by desire of Struyck, who compared it with 44 obs., by Cassini, and, as each obs. gave both L. and l., this operation produced 88 comparisons. Of these, 52 show errors of not more than one minute, and 9 only show more than two minutes.—(P., v. 2, p. 42-4.) It was scarcely visible to the naked eye. In a telescope of 16 feet, focal length, its diameter, including coma, did not exceed that of Jupiter—(H. A., 1729, p. 68, and M. A., 1729, p. 409.) On the five orbits given by Delambre, his entire note runs as follows:—"Pingré states that the elements of Struyck rarely differ 2' from the obs.: that

the errors of la Caille's reach $31'$ in L., and $1^{\circ} 15'$ and upwards, in l; and, nevertheless, the two orbits differ from each other scarcely $2'$ in L., $2\frac{1}{2}'$ in L. N., and $13'$ in L. P. The great difference in the errors arises, no doubt, from the P. D."—(D., v 3, p 421) We have no remark on Buerkhart's elements. Delambre has printed all the P. Ps. for June. July has been inserted in the Catalogue, for Maraldi's orbit, on the authority of M. A., 1743 Pingré gave I. of Maraldi's $= 76^{\circ} 53' 45''$. May has been given to Kiez's elements on Pingré's authority.—See H. A., 1743, p. 137, and M. A., 1743, p. 195 There are slight discrepancies between Delambre and Olbers in the P. Ps. of the orbits of la Caille and Kiez, and the Catalogue of the latter being the most recent, it has been given the preference.

1737 (1)—D u. On the 9th February, N S, this comet was seen in Lisbon and Gibraltar, with a tail 7° long Struyck gave 15 obs., by Bradley, comparing them with the places calculated from his elements, which show very small differences.—(Struyck, p. 301) The orbit given was taken by Delambre from Pingré's Catalogue.—(D., v 3, p. 421) Cassini obs. this comet from 16th February to 2nd April. Manfredi, from 25th February to 6th April. Bradley, from 26th February to 2nd April. At Spanish Town, in Jamaica, it was obs. on 6th February; and, at Philadelphia, on 7th, Whiston stated, that, at Newcastle, this comet was seen to eclipse ν Ceti. Bradley computed his orbit from his own obs. Machin fancied that it was identical with that of 1556, but soon retracted his opinion.—(P., v. 2, p 45.) Mr Bradley first saw the comet on the 15th February, 1737, O S, between 6 and 7 in the evening, when its nucleus appeared small and indistinct, and its tail extended above a degree from the body.—(P. T. Ab., v. 8, p 150)

1737 (2)—D u. Professor Schultes sent to Baron de Zach certain papers, in which were various astronomical obs., made in China, probably by the Jesuits, and among them is mentioned this comet, which Baron de Zach did not believe to have been seen in Europe. The superscription of the paper ran thus: "De duplici cometâ qui per hunc annum, 1737, Pekini apparuit, in eâdem cœli regione mensibus Febuario et Martio, ac Julio."—(M. C., B. 21, p 311) Neither Struyck nor Pingré noticed this comet. The elements given were computed in 1812; the obs. used are unknown.—(D., v 3, p. 421)

1739.—D., probably, by Zanotti. The best, or even the only complete obs. of this comet are those by Zanotti, made at Bologna, from evening of 28th May until morning of 28th August. Pingré gave two orbits, one by Zanotti and the other by la Caille, and stated, that Struyck compared the 36 obs., by the former, with the elements by the latter, and found the agreement generally satisfactory. He also tried 3 obs. with one set of elements, attributed to Zanotti, and found enormous

differences between the obs. and calculated places. This orbit, taken from the *Phil Trans*, was the only one known to Struyck, and is really inaccurate. If it be by Zanotti, he must have computed few obs. with a view to mark out the path of the comet, and the duration of its visibility. He certainly calculated the other orbit with the aid, as he says, of P. Matteucci. It is to be presumed that la Caille was unaware of this, when he gave himself the trouble of computing another orbit.—(P, v. 2, p. 46) Delambre gave two orbits, by Zanotti, the second of which, in his list, has been omitted in consequence of the remarks by Pingré.

1742.—D. u. This is the first comet of its year. Seen at Cape of Good Hope on 5th February, and following nights. In Europe this comet was not seen until March. Mr Grant, an Irishman, was the first to perceive it, on the morning of the 2nd. MM Cassini and Maraldi obs. it from the morning of the 5th March until evening of 6th May. The five last obs. were only made by lines and diagrams of the comet and neighbouring stars. According to M. Euler the period of this comet is 42 years: but he subsequently computed another orbit.—(P, v. 2, pp. 47-8) De l'Isle's obs. were made at St Petersburg. Mr. Grant's, at Paris. The comet appeared on 2nd March, to the naked eye, larger than any of the stars above the horizon. Its tail was from 4° to 5° in length.—(H. A., 1742, p. 78.) Cassini's obs. may be found in M. A., 1742, p. 68, in a paper by himself, and again, the Paris obs. reported by Maraldi at p. 303. La Caille's, at p. 315, where he says, that in 61 days, he made 40 obs. A map of the comet's path is affixed to la Caille's paper. The Pekin obs. were reported by M. de Marian, at p. 331 of same vol. He stated that the tail was obs. in China to have been 7° or 8° in extent. In addition to these, other obs. were sent from China by P. Gaubil.—(H. A., 1743, p. 150) Struyck's elements were founded on Cassini's obs., which they represent very well. Those by la Caille are somewhat different. Those by Zanotti do not agree within $30'$ with his own obs. Euler's first were computed from three obs., by de l'Isle, of 11th, 14th, 17th, March, the others, on obs. less close to one another.—(D., v. 3, pp. 421-2) Of the orbits in Delambre's Catalogue, we have omitted Zanotti's, and Euler's first, on the joint remarks of Delambre and Pingré, Le Monnier's, on account of no I. being given, and Euler's third, in consequence of its being so wide of the others.

1743 (1).—D., apparently, by Grischaw, at Berlin, on the 10th February. M. Zanotti did not esteem his obs. very correct, on account of the *smallness* of the comet. He made some obs. not included in the M. A., but did not communicate them, as they did not agree with the former. They extended to the 28th February. M. Maraldi made

one good obs. on 13th February, and another, pretty good, on 17th. The P. Frantz, Jesuit, made 7 obs. at Vienna, but only graphically, and without noting the times. Grischaw, at Berlin, also made some, but principally with reference to the nebulousity. Struyck said, reasonably enough, that the orbit could not be regarded as well determined.—(P., v 2, pp. 49–51) The edition of Struyck, at the Markece Observatory, being that printed in 1740, we have, of course, no remarks of his of later date. This comet was one of those small ones which could interest astronomers only. M. Maraldi perceived it, on 12th February, in Ursa Major. A cloudy sky prevented his seeing it again until the 17th and 18th. It had no tail, and was like a nebulous star.—(H. A., 1743, p 136) Maraldi's obs. may be found in M. A., 1743, p 193. See A. N., No. 44, for Olbers' remarks, and the expression of his opinion, that this comet was *not* the same as that of 1770. The elements by Struyck and la Caille, are founded on the obs. by Zanotti.—(D., v. 3, p 422) Clausen's orbit was deduced from three obs., by Zanotti, of 12th, 20th, and 28th February, on the supposition that the semi-axis Major = 3.10.—(A. N., No. 237) The period by this orbit = 5.458 years. There is a discrepancy in the orbit as given in A. N., No. 237. The semi-axis, ma. 3.10, and log P. D., give, for the eccentricity, 0.7220773. Olbers' elements were founded on the first obs. of Grischaw, on 10th February, Maraldi's, of 13th February; Father Frantz's, of 21st February, and Zanotti's, of 26th February. He stated that they agreed well with the two extreme places, and with the Ls of 13th and 21st February; but that they give the l. of 13th, too great by 14', and of 21st February, by 10'.—(A. N., No. 44) See note on 1819 (4).

1743 (2).—D. u. Obs., at Haarlem, by Klinkenberg, from 18th August to 13th September. Struyck also saw it at Amsterdam, on 18th August and six following days, and sought an orbit to agree better with the obs. than Klinkenberg's, but failed. The comet was very small, but was, notwithstanding, visible to the naked eye.—(P., v. 2, p. 51) Was obs. only by Klinkenberg, who does not guarantee his obs. within 10'. His orbit is but a rough approximation, agreeing, within about 1°, with the obs. from which it was computed.—(D., v. 3, p. 422; P., v. 2, p. 52.)

1744.—D., apparently, by Klinkenberg, at Haarlem, on 9th December, 1743, at 9 P.M. Betts's orbit was computed from 18 obs. some made by Lord Macclesfield, at Sherbourne; and some, at Oxford, by Mr. Bliss. The greatest difference between the obs. and calculated Ls and l.s is 37". The obs. were made from 3rd January to 29th February. Maraldi's orbit, from his own obs. and those of Cassini, made at Paris, on 31 different days, from 21st December, 1743, to 1st

March, 1744. He compared the places from his elements with the obs. but the result seems to be in favour of the preceding computer. La Caille does not state the foundation of his orbit. Zanotti obs. the comet on 25 different days, from 7th January to 5th March. His last 8 obs. were made between 11 A.M. and noon. The comparison between his elements and obs gave much the same result as Maraldi's. Olbers attributed this orbit to Mayer. Chéseaux's orbit was calculated from his own obs, made at Lausaune, from 13th December. He it was who informed Cassini of the appearance of the comet. Pingré said that Euler produced three different orbits: the first having been hyperbolic. G. Heinsius gave elements which he said were sent to him by Euler. These two orbits (Chéseaux's and Euler's) do not agree well with those furnished by others. Lastly, Euler, having received the Paris obs from Cassini, used them to correct his first elements, and gave birth to an elliptic orbit, certainly, but of immense length, and differing very little from a parabola, and he concluded that the period must extend to several centuries. (The period resulting from the elements, in fact, = 122683 years!!!) This is the one by Euler given in Pingré's, and in the present Catalogue. Pingré's orbit was calculated from the same data as that by Euler. It is also elliptic, but of *rather* less extent, inasmuch as the period equals *only* 21808½ years!! There is no remark by Pingré on Klinkenberg's orbit beyond the fact of his having computed it. Hiorter's is attributed to him in the Ast. Tables of Berlin, tom 1, p 39 — (P, v. 2, pp. 52-5) Was the largest, the most brilliant, and one of the most remarkable that appeared since the famous comet of 1680, from the length of its tram, size of its head, and proximity to the Sun. As, however, it only appeared in the month of December, of this year, it was in the following that it appeared in all its splendour. — (H. A., 1743, p. 136.) On 11th February, 1744, it presented a surprising spectacle to M. Cassini. The head, which had always before appeared nearly round, became oblong in the direction of the tail, and was divided into two portions by a black streak, of which the northern portion was the smallest, and had a kind of beard brighter than the tail, fringed by two unequal obscure spaces, separating it from the coma, and of which the eastern was the largest. This singular phenomenon disappeared on the following days:—On the 15th February the tail was divided into two branches; the eastern being from 7° to 8° in length, and the western, 24°. On the 23rd February the tail became curved, the convex side being the western.—(H. A., 1744, p. 32.) Maraldi's obs. are in M. A., 1744, p. 58 Cassini's are in the same vol., p. 301.—See M. C. Band 21, p 311. This comet ought to be one of the best known, both on account of the number of calculators, and also the agreement of the elements — (D., v. 3, p 422) Cassini's orbit is not

spoken of by Pingré; and from what the latter says of Euler's other orbits, the second in Delambre's Catalogue has been omitted in the present.

1747 —D by Chéseaux, at Lausaune, on 13th August, 1746. Pingré published his obs. Illness interrupted his work, but, notwithstanding, he saw it on 6th, 7th, and 15th October, and for the last time on 23rd November. The greatest difference between his obs places and those deduced from his elements = $3' 14''$. Maraldi did not see this comet before 31st August, nor obs. it before the 8th September. He continued his obs. until 5th December. To his own 24 obs he added 6, by Chéseaux, made in the month of August, and computed an orbit which agrees pretty well with the 30 obs., still, in 13 instances, the difference between obs and calculated places exceeds 2 minutes. La Caille did not state on what foundation he rested his elements.—(P., v. 2, pp 56–8) This was the faintest and smallest comet seen up to this date. On 7th September it appeared to Maraldi like a white oblong cloud, of which the greater diameter extended E and W., and might have occupied about $6'$ or $7'$. Neither head, tail, nor nucleus was visible. It is singular that M. de Chéseaux expressly stated in his letter to M. Cassini, that, with a reflecting telescope of 18 inches, the nucleus of the comet was seen not in the centre of its atmosphere; and that there proceeded from this atmosphere a tail of the length of 24 minutes, and breadth of 12 minutes —(H. A., 1746, p. 93.) Maraldi's obs. are given in M. A., same vol., p 55. Delambre gave Chéseaux's, with two other orbits, and the note by him states: "Chéseaux calculated his orbit on his own obs. Maraldi on his own and six by Chéseaux. Maraldi's orbit seems to be the best; that of la Caille scarcely differs from it." —(D., v. 3, p. 422.) Chéseaux has been omitted from the present Catalogue.

1748 (1).—D. u. This comet was discovered at the latter end of April, and was seen by the French king and all his court, at Choisi, on the 4th and 5th May. Maraldi obs. it from 9th May to 30th June. The greatest difference between obs. and computed places, deduced from his orbit, was for obs., 11th May, = $9' 37''$ in L, and $4' 7''$ in l. Pingré thought that the obs. of both 9th and 11th May were faulty. This comet was also obs., at Pekin, from 26th April to 18th June. —(P., v. 2, p 58.) It appeared, to the naked eye, on 9th May, rather larger and brighter than the nebula in Andromeda. It had a tail about 2° in length; and, with a telescope of 8 and 15 feet, a nucleus was perceivable, brighter than its atmosphere, and centrally situated in it.—(H. A., 1748, p. 98.) The obs., by Maraldi, are recorded in M. A., same vol., p. 229. He computed from his own obs.—(D., v. 3, p. 422.) Pingré gave L. P. of Klinkenberg's orbit = $215^\circ 23' 29''$.

1748 (2)—D., apparently, by Klinkenberg, on 19th May. This second comet was seen at the same time as the first; the first being in the north, the second in the west. The present had no tail, but a brighter nucleus than the first. It was obs. only three times, and by Klinkenberg alone.—(P., v. 2, pp. 59, 60.) “Struyck computed from three obs., both very rough and very close to one another. By a new reduction Bessel obtained elements which represent the obs. This, however, does not, perhaps, go to prove much in favour of the orbit.”—(D., v. 3, p. 422) Under such circumstances, it is to be feared that bad is the best of the two orbits.

1757.—D., apparently, by Bradley, on 13th September. His obs. were made from the morning of this day to morning of 18th October. The comparisons made between obs places, and those deduced from his elements, in no instance exceeds two-thirds of a minute. Pingré, when calculating his orbit, had no knowledge of Bradley's obs, which he stated to be undoubtedly the best of all that were made.—(P., v. 2, pp. 61-2.) The celebrated comet of 1682, of which the return was predicted for 1757 or 1758, was the cause of the discovery of many unexpected. It is not known, precisely, who was the first to discover the present comet, the public news having announced it from Germany and Holland. Klinkenberg, at the Hague, was the first who obs. it well, and determined its position on the morning of 16th September. It was soon after observed also by other astronomers, (the list is too long to quote).—(H. A., 1757, p. 108) Lengthened remarks, by Pingré, are inserted in M. A., 1757, p. 97. He stated, on the authority of Klinkenberg, that on the morning of 16th September, the tail of the comet did not exceed 10' or 12' in extent. On the 5th October it appeared to Pingré in the shape of a fan, the extremity being about 4' broad, while the coma was about 2'. De Ratte's obs. may be found in M. A., 1761, p. 48. Bradley computed from 16 obs. made by himself. His elements merit the most confidence, but the other three orbits differ little from them.—(D., v. 3, p. 422) In Delambre the I. of De Ratte's orbit is given = $12^{\circ} 41' 7''$. M. A. agree with Pingré, and their account is adopted in present Catalogue When Dr. Bradley first discovered this comet, it appeared, to the naked eye, like a dull star of the 5th or 6th mag., but viewing it through a seven feet telescope, he could perceive a small nucleus, surrounded, as usual, with a nebulous atmosphere, and a short tail extended in a direction opposite to the Sun. On the morning of the 19th October it appeared so faint that he could not observe its place. The comet kept nearly at the same distance from the earth for 10 or 12 days together, after he first saw it, but its brightness gradually increased then, because it was going nearer to the Sun. Afterwards, when its distance from the earth increased, though it continued to ap-

proach the Sun, yet its lustre never much exceeded that of stars of the 2nd mag., and the tail was scarcely to be discerned by the naked eye.—(P. T. Ab., v. 11, p. 169.) As the obs. made by Klinkenberg, on this comet, appeared to him to be too incorrect to undertake a calculation for ascertaining its path by the theory, he contented himself with effecting it by a construction. By this means he found on a figure, whose globular or spherical diameter was $13\frac{1}{2}$ Rhineland inches, as follows.—That the comet was in its perihelion, 21st October, at 2 P. M. The place of the perihelion, 3° in Leo. The comet's distance, in the perihelion from the Sun, was about 34 parts, of which 100 make the mean distance between the Sun and the earth. The inclination of the comet's orbit with the ecliptic, 13° ; and the S. latitude of perihelion, also, 13° ; the ascending or N. node, 43° in Scorpio; and the comet's motion direct, or according to the order of the signs of the zodiac. The result of a comparison between the places computed from this theory, with the observed places, was singularly satisfactory.—(P. T. Ab., v. 11, pp. 190-1.)

1758.—D. by M. de la Nux, in the Isle of Bourbon, on 26th May. It was south of the last star in the belt of Orion. On 8th June it was in the eastern shoulder of this constellation. On the 18th June, and following days, it was seen in London, in Auriga, very near the horizon. Messier, at last, found it on the morning of 15th August. He obs. it, uninterruptedly, weather permitting, until the evening of 2nd November. De l'Isle, whose pupil Messier was, would not permit him to communicate his discovery to the other astronomers of the academy!! Pingré pronounced the obs., by Messier, to have been very good: the orbit given was computed from them.—(P., v. 2, p. 62.) M. de l'Isle's paper on this comet is inserted in M. A., 1759, p. 154. He stated that its tail was seen in London on 18th June, and that Messier was employed in looking out for Halley's comet when he discovered the present. Messier could not distinguish the nucleus from the body of the comet, except by a greater whiteness in the centre, the coma being about the diameter of Jupiter; but it was very difficult to ascertain its extent, in consequence of its feeble light. Messier's obs. are included in M. de l'Isle's notice, which is of great length, but contains no very interesting remark.

1759 (1).—D. u. The fifth well-ascertained apparition of Halley's comet; and it was upon this occasion that Halley's prediction was verified. Clairaut announced the P. P. for about 13th April, remarking, at the same time, that, on account of the complication of the perturbations, he was obliged to neglect some combinations, and that, consequently, the time of P. P. might be a month wide of the mark, which turned out to be the case. The comet was first seen by a peasant of

the neighbourhood of Dresden. The difference between Klinkenberg's two orbits arises from his having assumed the period to be known in computing his first elements, and treated the comet as having appeared for the first time in his second set; whatever may be the discrepancy, both orbits represent la Caille's 22 obs. equally well. Messier's orbit was calculated from a greater assemblage of obs than most of the others, he having obs. the comet on 47 different days, both before and after P. P. Lalande's was founded on an obs. made at Toulouse, by Darquier, on 16th April; a second, in London, (? Greenwich,) by Bradley, on 1st May; and a third, at Paris, by himself, on 21st May. Cassini de Thury suspected some error in the obs. of 1st May, and Pingré thought the suspicion well founded. Neither this obs. nor any by Bradley is recorded in the *Phil. Trans.* Maraldi's rests on an obs. by la Caille, of 13th April, and on those, of 1st and 18th May, by himself. From the 1st to 28th May he made 24 obs., giving 48 comparisons. Of these, the difference, in 23 instances, are less than one minute; and in 18 others, under two minutes. Of la Caille's two orbits, the second, at least, was computed from his own obs. Bailly calculated from 22 obs. by la Caille. He made the resulting 44 comparisons with the places deduced from his orbit. In 18, the differences were within one minute; in 18 more, between one and two minutes; in 6, between two and three minutes; and in the remaining 2, they exceed three minutes.—(P., v. 2, pp. 63–8) Clairaut's remarks may be found in *M. A.*, 1759, p. 115, and Maraldi's in the same vol., p. 279. Again, la Caille's, in *M. A.*, 1760, p. 53, and Cassini de Thury's, in *M. A.*, 1767, p. 241. This celebrated comet is so well known, and has been so often described in popular works on astronomy, that any further remarks upon it would be unjustifiable. Lalande's orbit has been omitted from our Catalogue on account of the uncertainty of Bradley's obs. of 1st May. Period, by Burckhardt's orbit, = 76.44 years. Rosenberger's first set of elements are the most probable results from the obs. of 1759, alone, the second set differ from the second of 1682, only, in consequence of precession and perturbations. See *Z. C.*, v. 6, p. 197, and Notes on comet, 1835 (2).

1759 (2) —D by Messier on 25th January, 1760. The third comet attributed to this year, and so called on account of its date of P.P., was discovered before the present one, both having first become visible in 1760. It was obs. at Paris, from the 8th February, by Cassini de Thury, le Monnier, la Caille, Chappe, &c. Pingré asserted that de l'Isle would not permit the announcement of its appearance to be made to the academy before the above-mentioned date!! Cassini de Thury's obs. were given by Pingré, who said, that la Caille's elements did not agree so well with the obs. as his own. Chappe computed from an obs., by Messier, of 25th January, and from those of 22nd February and 16th

March, made by himself.—(P., v. 2, pp. 68–70.) Pingré's comparison of his elements with the obs are in M. A., 1760, p. 152. La Caille's obs. and elements are in the same vol., p. 147. He stated that there was scarcely any sign of a train, and the little there could be seen was only visible in a telescope. A memoir, by Messier, is inserted in M. A., 1772, part 1, p. 421. He considered the diameter of the nucleus to be about 30". It had a train of light of about 3° in length, on 26th January. On the night of 5th 6th February, it appeared, to the naked eye, like a 4th mag. star; the nucleus, as seen through a telescope, surrounded by a feeble nebulosity. On 7th 8th February, the tail appeared several degrees in length, directed towards α Leonis. On 8th 9th, its extent was 4°, the nucleus resembling a star of 6th mag. On 9th 10th, it had increased to 5°, &c, &c. There seems to be a strange discrepancy in the evidence on the physical nature of this and the following comet. A map of its path is appended to Messier's memoir, p. 434.

1759 (3).—D. by all the astronomers of the Academy, at Paris, on 8th January, 1760. It was observed at Marseilles, and seen at Lisbon, on 7th January, in London, and elsewhere. Struyck fancied that it resembled the comet of 1664. La Caille's elements rest on his own obs. of 8th and 16th January, and 3rd February. Chappe's, on an obs. by Maraldi, of 8th January, and on two of his own, of the 12th and 16th of the same month.—(P., v. 2, pp. 70–1.) This comet appeared in Orion, surrounded by a coma of rather less than the lunar diameter. Through a telescope, its nucleus was pretty well defined. On 8th January, at 9 P.M., it was 14 times nearer to us than the Sun.—(H. A., 1760, p. 112.) M. de Thury's obs. are recorded in M. A., 1760, p. 98, and La Caille's in same vol., p. 157. Chappe's remarks on the elements of this and the preceding comet are introduced at p. 166. The nebulosity of the present comet continued in view during its apparition; that of the preceding became invisible some time before the disappearance of the comet itself. Chappe attributed the difference between the two comets, in this respect, to the lesser P. D. of 1759 (3). A memoir, by Messier, on the subject of this comet, may be perused in M. A., 1772, part 1, p. 333. He stated that, on 8th January, the light of the nucleus was bright and reddish; that he measured its diameter, and found it to be 34", that of the nebulosity being 15'. Its tail was 4° in length. On the 12th, the diameter of the nucleus was only 20". Mr. James Short, who obtained a meridian obs. of this comet on January 9th, mentioned that its nucleus was small, subtending an angle of not more than 5 or 6 seconds, but very visible through a two feet reflector, magnifying about 70 times; and that it was very visible to the naked eye, though no tail could be perceived.—(P. T. Ab., v. 11, p. 428)

1762.—D. by Klinkenberg, on 17th May. Messier obs. it from

29th May to 2nd July. Maraldi, from 1st June to 2nd July. The latter computed from 16 obs. made by himself. In his comparison of calculated, with obs. places, he found the difference, in 13 instances only, to be less than 2'. In 17 comparisons it exceeded 4', and in one, = 8' 7". Lalande's orbit rests on an obs. by Messier, of 31st May, and on two, by himself, of 12th and 24th June. On comparing his elements with the obs. he found the differences, sometimes, rather large. Bailly's elements were founded on 9 obs. by himself, between 4th and 25th June. The result of 18 comparisons, which they furnished, gave 9 under 2', and it twice exceeded 5'. (Pingré gave $L. P. = 104^{\circ} 24' 0''$. Delambre agreed with M. A.) Klinkenberg's orbit was computed from his own obs., of 17th May, and on 20 obs. by Messier. The comparisons gave 23 differences under 2'; 17, between 2' and 5'; one, of 5', and one, of 7' 14". Struyck compared the places calculated from his elements with 26 obs. by Messier, Klinkenberg, and others. The comparisons gave, generally, differences below 2', the greatest being = 4' 40". We may, hence, conclude that this is the best orbit.—(P., v. 2, pp 71-2.) Burckhardt ascertained that the reductions had not been made with sufficient accuracy, as the effects of refraction had been neglected. Hence the great diversity of his orbit from the preceding.—(D., v. 3, p. 422.) On its discovery, at the Hague, this comet resembled a star of 4th or 5th mag., surrounded by a feeble nebulosity. It could scarcely be seen with the naked eye. The nucleus was tolerably bright, but ill-defined. It had a small tail.—(H. A., 1762, p 125.) Maraldi's obs. are recorded in M. A., 1762, of same vol., with a map attached. There is another memoir of this comet, by M. Bailly, in M. A., 1763, p. 229. Burckhardt's elements are given in A. J., 1810, p. 225.

1763.—D. by Messier, on the evening of the 28th September. Pingré stated that he had no knowledge of any obs. but his. On the evening of his discovery, on the 29th September, and 2nd October, Messier could merely estimate its place in the sky. On the 30th September, 3rd October, and on other days, up to the evening of 25th October, he determined its position by regular obs. The comet was in perihelion on 2nd November, but clouds prevented Messier from seeing it between 25th October and the morning of 12th November. From this date to 25th November, (the day on which he saw it for the last time,) he obtained several positions. Pingré declared that, of all the comets of which he had computed the elements, this was one to which he had devoted the most time. Also that all his sets of elements agreed very ill with the obs. ls. and Ls in September, &c —(P., v. 2, pp. 73-4.) He, however, adopted an orbit which is inserted in his general Table, and which is the second included in the present Catalogue. The sc-

cond by him, as introduced by Delambre, has consequently been rejected. It appears to have been entered from M. A., 1764, p. 487, without consulting Pingré's work, published 20 years afterwards. Messier's memoir on this comet is inserted in M. A., 1774, p. 23. He stated that, on the 28th September, it was not visible to the naked eye. With the telescope he was, at first, doubtful whether or not it was a nebulous star. With a Newtonian, of $4\frac{1}{2}$ feet, the centre light alone gave traces of an ill-defined nucleus. On the 4th October the nebulosity appeared to be about 7' or 8' diameter. On the 24th the nucleus was sufficiently defined to be measurable. It was about 11" in diameter. The comet never showed any appearance like a tail. It is surprising that this comet seemed so small as it passed so near to the earth. On the 28th September it was distant only the 6th part of the mean radius of the earth's orbit. Delambre stated that Burckhardt employed the previously unknown obs. of St. Jacques Silvabella. His second orbit is an ellipse with a period of 7334 years. With such a revolution the parabola should suffice.—(D., v. 3, p. 422.) For Burckhardt's remarks, &c., see M. C., v. 10, p. 507.

1764.—D. by Messier, on the 3rd January. He obs. it from this time until the 11th February. Pingré calculated the orbit three times. His first elements rested on no other data than the obs. made between the 3rd and 11th January. Before the end of this month he transmitted to the Academy an ephemeris, preceded by a second set of elements, perfected from obs. by Messier, to the 22nd January. This second set was published in the M. A. before the first, and in the first there is a typographical error. M. Messier, having continued his obs. to the 11th February, the day before the P. P., Pingré revised the second orbit. The third differs, as may be seen, but little from the second, but it is more exact.—(P., v. 2, pp. 74-5.) The third is the only orbit given by Pingré. It is the first in Delambre's list.—(D., v. 3, p. 423.) The ephemeris above alluded to is in the M. A., 1764, p. 344. It is also mentioned in the same vol., p. 487, that the comet passed very near to the earth on the 3rd January. Messier's memoir upon it appeared in M. A., 1771, p. 506. He stated that he saw it on the night of his discovery with the naked eye, that it was very bright, and situated near to θ Draconis. Its ill-defined nucleus was only remarkable for its brilliancy. The nebulosity was 13' or 14' in diameter, and it had a tail of $2\frac{1}{2}$ degrees in length. On the 9th its light had much diminished, but it was still visible to the naked eye as a star of 4th or 5th mag., with a train of about 2 degrees long. On the 11th February the nucleus was very bright, with scarcely any surrounding coma, and it was many days later that he satisfied himself that it was the comet that he had seen. A map of its obs. path is appended to this memoir.

1766 (1).—D. by Messier, on the 8th March, during a search for the suspected satellite of Venus, and was observed by him for eight consecutive days. Pingré calculated the orbit on Messier's obs., and compared the results with them, which gave him 16 comparisons. The difference between calculated and obs. places were always under 2', more frequently under 1'. Cassini de Thury also observed this comet. He compared his obs. with Pingré's elements, and was satisfied with their agreement. Chappe likewise obs. it on 11th, 12th, 14th, and 15th March. Pingré's elements represent pretty well his first three obs.; not so well the last, but Chappe gave it as less accurate than those of the preceding days. Notwithstanding, Pingré presented his orbit only as an approximation—(P., v. 2, p. 75.) Delambre observed that the orbit was doubtful, on account of the slowness of the apparent motion—(D., v. 3, p. 423.) Pingré's memoir may be consulted by reference to M. A., 1766, p. 423. He said that on the day of the discovery the comet's distance from the earth exceeded that of the latter from the Sun by one-fifth. Messier's memoir is inserted in M. A., 1773, p. 157. He described the phenomenon as seen in a five feet achromatic on the day of discovery, to be like a small nebulosity, with luminous centre.

1766 (2).—D. probably by Helfenzrieda, on the 1st April. It was obs. at Paris, by Cassini de Thury and Messier for only five consecutive days, viz: 8th to 12th April. Pingré computed an orbit on Messier's obs. The elements agreed pretty well with these obs., but he subsequently became acquainted with others, which were irreconcilable with his theory, and he was forced to discard it. Multiplied calculations gave him new theories, very different from the first, and, nevertheless, as accordant with the obs. of Messier. So true is it that one should mistrust cometary orbits computed from obs. with small intervals between them, at least when the rapidity of apparent motion does not compensate for the short duration of visibility. P. Jean Helfenzrieda, of Dillingen, in Suabia, wrote to Messier, to say that he had seen the comet from the 1st April, but, being unprovided with instruments, he could only estimate its place with the naked eye. He added that two persons had obs. it on the 6th, at Ingolstadt. Upon hearing this, he wrote to them, requesting to have their obs. Their reply was unsatisfactory. In an ephemeris, which Pingré constructed from his first orbit, he announced that the comet would reappear after perihelion. It *did* reappear, but in a position in which it could not be obs. in Europe. La Nux, in the Isle of Bourbon, endeavoured to supply, to the best of his ability, what he conceived that we could not effect, and followed the comet from 29th April to 13th May.—(P., v. 2, pp. 76–82.) Pingré evidently places little confidence in

la Nux's obs., as he had no instruments ; he, however, gives them in detail. Cassini de Thury's obs are to be found in M.A., 1767, p. 322. He stated that on the night of the 9th April the comet appeared very brilliant to the naked eye, with a tail of from 3° to 4° . Messier's memoir is inserted in M.A., 1773, p. 163. He said that on the 12th April the light of the comet was feeble, the nucleus ill-defined, and the tail only $1^{\circ} 30'$ long, but these appearances were to be attributed, in a great degree, to the strong twilight at the time. A map of the paths of both the comets of this year is annexed to this memoir. From a note extracted from Olbers' Catalogue, it seems probable that he computed his orbit from Messier's obs. of 5 days. Mr Alexander Brice describes the appearance of this body on April 9th and 10th, thus — "The tail was very visible to the naked eye ; but the nucleus could not be seen without a telescope, through which it appeared very distinctly, like a star of the 4th or 5th mag. It was surrounded with a gleam of light, like what is seen around the stars in Orion's sword, commonly called Janua Coeli"—(P. T. Ab, v. 12, p. 287)

1769.—D. by Messier, on the 8th August. A remarkable one on many accounts. Pingré, being at sea, saw, or fancied that he saw, undulations in its tail. He perceived two arcs, bent in opposite directions, and named la Nux as a witness. The tail, as seen by them was 90° , and even 97° in length. Euler's and Lexell's orbits are elliptic. The latter gives a period of from 449 to 519 years. The first orbit by Pingré in the Catalogue is also elliptic, and the revolution 1231½ years. He does not conclude that it was identical with that of 539. Bessel's elements are elliptic ; the period being 2089.8 years ; but an error of 5" in the obs. would give for results 2673 or 1692 years. If the parabola be not sufficient for such long ellipses it will never suffice.—(D, v. 3, p. 423) Delambre gives in his note on this comet, the orbit by Asclepi, which is added to the present Catalogue from Olbers. This beautiful comet was obs. wherever there were observers. Maskelyne's obs. are to be found in his collection, printed in London in 1776. They extended from the 8th August to the 15th September, before the perihelion, and from the 24th October to 1st December, after the perihelion. La Nux obs. it in the Isle of Bourbon from 26th August to 26th September. Pingré was between the Canaries and Cadiz when he saw it, from 27th August to 16th September, and added to what has been already quoted from Delambre by specifying the 4th September as the time when the undulations were most remarkable, and that the motion resembled that of Auroræ Boreales. Maskelyne estimated the length of tail on the 28th August to be 7° , Messier 15° , Pingré and la Nux 19° to 20° . On the 19th September, according to Maskelyne, it was 43° , Messier 55° , la Nux 60° , Pingré 75° . Lalande computed his elements

from obs. by Messier, of 14th August, 15th September, and 4th November. Wallot, by Lalande's desire, from the first two of the preceding, and one of 1st December. Cassini jun., calculated from obs. by his father, Maraldi, and himself, and compared the results with the obs. On 42 comparisons the difference exceeded 3' in 25 instances, and was sometimes 4' or 5'. Prosperin's orbit was deduced from Wargentin's obs. The P. P. in M. A., 1769, p. 56, differs totally from that in 1775, p. 430; and Olbers' Abh. differs from both. With Pingré we have followed M. A., 1775. Audiffredi's, Slop's, and Zanotti's from their own. We have adopted the same course on Slop's as in the case of Prosperin's orbit under similar circumstances. On 44 comparisons by Slop the differences are under 2' in 38, and only twice exceed 3'. On 35 comparisons by Prosperin, 6 differences exceed 4'. Audiffredi's are still less satisfactory: the differences sometimes exceeding 9' and even 10'. As to the orbit of Zanotti it differs so prodigiously from all the others that it has been omitted. In his comparisons he found the differences too often exceeding 8', 9', 10', and even 11'. Pingré calculated his elliptic orbit from Messier's obs. of 21st August, 25th October, and 1st December. It differs little from that by Lexell.—(P., v. 2, pp. 83-5) As Pingré gave only one of his orbits in his Catalogue, the two others given by Delambre are omitted in the present. The preceding remarks by Pingré have induced the omission also of Cassini jun., Audiffredi's, and Zanotti's. In addition to the observers already named there were d'Arquier at Toulouse, St. Jacques and Poitevin at Marseilles, la Grange at Milan, Mayer at Petersburg, Lintenberg at Gottingen, and Tosiguo at Cadiz. Lalande computed his orbit upon the entire collection of obs. which came to his knowledge.—(H. A., 1769, p. 90.) Lalande's memoir is introduced into M. A., 1769, p. 49. He adds to the foregoing that this comet was obs. by Matteucci at Bologna, by le Gentil at Pondicherry, and that Wargentin obs. it at Stockholm. Also, that according to Zanotti's calculation, supposing the tail of the comet to have been directly opposed to the Sun, and that on the 12th September its apparent extent=74°, its actual length exceeded 12 million leagues. Cassini jun.'s obs. and theory are inserted in M. A., 1770, p. 24. The tail of this comet, as seen in a telescope with a magnifying power of 20, did not appear of uniform light, but composed of jets of rays which seemed to radiate from different points of the nucleus, and which were separated by dark intervals. These appearances varied extremely.—(H. A., 1775, p. 34.) Messier's memoir may be found in M. A., 1775, p. 392. He estimated the length of the train at 6°, the diameter of the nebulosity at 4' 30", and of the nucleus at 1' 26", on the morning of 15th August. On the night of 25th 26th August he examined the nucleus with a three and a half feet telescope, and considered it to be nearly equal in diameter to

Jupiter, with a tail of about 4° . On 27th 28th, 5° , and 30th $31^{\text{st}} = 24^\circ$, the diameter of nucleus being $2' 9''$. On the 2nd 3rd September the tail $= 36^\circ$, and diameter of nucleus $= 2' 53''$. On 3rd 4th, tail $= 40^\circ$, and diameter of nucleus $= 3' 15''$. On 4th 5th, tail $= 43^\circ$, diameter of nucleus $= 3' 40''$. On 5th 6th, tail $= 49^\circ$, diameter of nucleus $= 4'$. On the morning of the 9th, tail $= 55^\circ$, and on 10th $= 60^\circ$. On the 26th October, tail $= 3^\circ$, with diameter of nucleus $= 1' 22''$. On the 27th October and 1st November the diameter of nucleus $= 1' 22''$, with, on this latter date, a length of tail $= 6^\circ$. On the 8th November, tail $= 2\frac{1}{2}^\circ$, on the 15th $= 1^\circ$, and on 17th $= 1\frac{1}{2}^\circ$. On the 18th the diameter of nucleus $= 32''$, the tail continuing of the same apparent length as on the 17th, until it disappeared. There are other interesting remarks on the physical nature of this comet in the same paper, but which are of too great length to introduce here. We could not find any mention made of the eccentricity of Euler's orbit. Asclepi and Boscowitch's elements give a period $= 927$ years.

1770 (1).—D. by Messier, on the 14th June, and assiduously obs. by him till the 2nd October. Many other astronomers also obs. it. This comet was remarkable for the trouble it caused to computers. Pingré at first calculated the orbit upon Messier's earliest obs. He thought it advisable to set aside those of the 14th and 30th June, and of the beginning of July; Messier having stated in his memoir that on these days he had not *observed* the comet, but only estimated its place. The first obs made in August did not agree with Pingré's elements, and he computed others with pure loss of time. After the comet ceased to be visible in October, he uselessly tried new orbits; those which agreed with the later obs. differed from the first, and *vice versa*. He allowed for refraction, parallax, and aberration with no better success. At last, resting on the obs. of 2nd, 8th, and 14th August, made near the P. P., he obtained seven different orbits, which equally represented the obs. selected, and he added that he might have found a great many more!! The first of these was nearly accordant with the second elements of Prosperin. He gave another (the second in his Catalogue), which differs much more from them. This latter, as well as the other six, applies to the obs up to the 19th August, but no farther. What Pingré did at Paris was likewise done by Prosperin at Upsala; who remarked with reason that it is near the *summit* of the orbit; that the parabola differs most from the ellipse, and added that he thought that the variation between his first and third orbits might be accounted for by perturbations, caused by the proximity of the earth to the comet. M. Widder, of Groningen, was of the same opinion, and thought that the orbit underwent a change between the end of June and beginning of July; yet he computed a single orbit from Messier's obs. of 25th and 29th June, and 14th and 19th September. The least distance of the

comet from the earth was at the end of June = 750,000 leagues; and Pingré conceived, in unison with M. Sejour, that this distance was too great to admit of changes by perturbations sufficient to authorize the multiplicity of theories proposed by Prosperin. Besides, wherefore should the elements differ in August and September? The action of the earth must have produced its entire effect at the commencement of July; according to Lexell's elliptic orbit, the comet's distance from Jupiter on 27th May, 1767, was only $\frac{1}{18}$ th of that between the comet and the Sun; and this action was the more adapted to alter materially the orbit, inasmuch as the motion of the comet was at that time very slow. The obs. by Maskelyne are to be found in his collection.—(P., v. 2, pp. 85-90) The comet was obs. in Paris to the 18th October.—(H. A., 1776, p. 35.) Messier's memoir is inserted in M. A., 1776, p. 597. He stated that on the night of his discovery, the comet showed a very feeble nebulosity, occupying little space; the centre was brilliant, but it was difficult to decide whether the object were a nebula or a comet. He could observe no relative change of its place in comparing it with fixed stars, during two hours. On the night of 17th 18th June, the diameter of the nucleus = $0' 22''$; that of the nebulosity = $5' 23''$. On the 20th 21st, it appeared for the first time to the naked eye. On 22nd 23rd, the diameter of nucleus = $0' 33''$, and that of coma = $18'$. On 24th 25th, the former = $1' 15''$; the latter = $27'$. On 29th 30th, the former = $1' 22''$, the latter = $54'$, without any sign of tail. On 1st 2nd July, the former = $1' 26''$; the latter = $2^{\circ} 23'$, and still without any train. On the morning of the 3rd August, the former = $0' 54''$, the latter = $15'$. On 11th 12th, the former = $0' 43''$; the latter = $3' 36''$. On 26th 27th, the comet ceased to be visible to the naked eye; but a train from it, extending to about 1° , was seen in a telescope. On 28th 29th, the tail was obs. to be much the same as before. Messier's last obs. was made on the morning of 3rd October. The obs. made by several astronomers are added to this memoir, as also two charts of the comet's path.

Delambre's Catalogue contains 14 orbits. In his note on this comet may be found the following remarks:—"This is the only one, the orbit of which, up to this date (probably 1813) cannot be represented by a parabola. Lexell found an ellipse with a period of 5.58513 years, having a semi-axis major = 3.1478606. Burckhardt, in his paper, to which was awarded the prize of the Academy, confirmed this result, with very slight modifications. He examined all the causes which have hitherto prevented the reappearance of the comet. Laplace furnished analytic formulæ, from which Burckhardt computed the effects of the perturbations by Jupiter. The axis-major has sensibly increased, and the comet will always be too far from the earth to be visible, unless it should undergo these disturbances in an opposite direction. Both of

Burekhardt's orbits are elliptic. Of the first the semi-axis major = 3.14346, and the revolution = 5.578296 years. Of the second, semi-axis ma. = 3.14429, and period = 5.577406. There is again a discrepancy between Delambre and Olbers on the P. P. of the second of these orbits, and, as before, it has been preferred to retain Olbers'. This comet is also that which has approached the nearest to the earth."—(D., v. 3, p. 423.) See Lexell's paper in A. J., 1781, p. 21, and for Clausen's orbits, his extensive memoir, which occupies three numbers of A. N., viz.: 439, 440, and 441. For Leverrier's most interesting notice on this comet, the reader must necessarily be referred to the C. R. of the 1st May, 1848. In truth, all that has been written on this phenomenon would make a volume. Clausen's first orbit was computed from obs. made before, and his second from those made after P. P. A liberty has been taken with the P. P. of Leverrier's orbit; it being presumed that in the C. R. the date 14 has been inadvertently printed for 13. The elements by Asclepi and Boscowitch give a period of 927 years. Those of Pigné = 5.4288 years; Clausen's first = 5.6068; second = 5.5997 years, and Leverrier's the same as the last—See Z. C., v. 2, pp. 208–307, and the note in this work on comet 1819 (4.)

1770 (2).—D. uncertain. This comet did not appear before January, 1771. It was obs. by Messier on 10th, 16th, 17th, and 20th January. Boscowitch saw it at Milan on the 10th and 11th January. La Grange, in the same city, obs. it on the 9th and 10th; those of the latter date entirely disagree with Messier's of the same day. Lastly, it was obs. on the 9th, 10th, 11th, and 13th January, by la Nux, in the Isle of Bourbon. It traversed 40° in app. right ascension, and 21° in app. declination within the extreme obs. made by Messier, so that some confidence may be placed in the orbit given, which was founded on his obs.—(P., v. 2, pp. 90–91, and D., v. 3, p. 423.) In M. A., 1771, p. 427, the P. P. is given 22nd November, $22^h 5^m 48^s$ M. T. Paris. Pigné has it 22nd November, $5^h 48^m 0^s$ M. T. Paris, which Olbers adopted, and the same has been taken for the present Catalogue. Messier remarked that in the telescope its nucleus was bright, of a whitish complexion, and not very well defined, surrounded with an atmosphere several minutes wide, with a faint tail, 5 or 6 degrees long.—(P. T. Ab., v. 13, p. 104.)

1771.—D. by Messier, on the 1st of April, and obs. by him till the 19th June. Wargentin, at Stockholm, did not obs. it before the 18th April, and the strong twilight in Sweden prevented his following it beyond the 16th May. St. Jacques de Silvabella, at Marseilles, continued his obs. from the 22nd April to the 17th July, but it does not seem that those which he reported were as accurate as Messier's. He had many others which he was unable to reduce for want of a good Catalogue of

stars. Bouin and de Laque obs. this comet at Rouen, from the 12th April to the 24th May. The obs. by Maskelyne, at Greenwich, extended from the 14th April to the 30th May. Pingré computed from Messier's first obs. Prosperin calculated from Wargentin's. Pingré thought that the orbit by Prosperin might be relied on.—(P., v. 2, pp. 91-2.) Burckhardt looked upon the elements as hyperbolic, and that there must be very improbable errors in the obs. to make it elliptic.—(D., v. 3, p. 424.) On the 2nd June, at about 9 P.M., Messier saw a light similar to that of the tail of a comet. It appeared in Gemini, and was about 25° in length, and 7° in its greatest breadth. This phenomenon lasted only half an hour, and disappeared gradually.—(H. A., 1777, p. 47.) Messier's memoir on this comet is inserted in M. A., 1777, p. 154. On the 1st April its nucleus was very brilliant, equalling the light of ϵ Arietis, and was surrounded by a nebulosity with a train of $2\frac{1}{2}^\circ$ in length. The diameter of the nucleus = $1' 22''$.—(Query, coma) On the 6th the tail seemed very much wider. On the 7th, diameter of nucleus = $1' 33''$. The light seemed somewhat brighter on the 15th. On the 24th the train was faint; no change in its extent was remarked before the 31st May, when it was only 1° . On the 7th June, the light of the comet had sensibly diminished. Messier added to his memoir two charts of the path, and a drawing of the singular cone of light already mentioned. Upon this comet Encke wrote as follows:—"Of all the comets, the computation of whose orbits have been undertaken to the present time (1820), that of 1771 is, according to the opinion of Burckhardt, the only one of which one can maintain with some certainty, that its motion was hyperbolic. Many circumstances unite to give weight to this assertion. It was obs. for three and a half months. It traversed an heliocentric arc of 116° . Burckhardt found by Laplace's method, an hyperbola, with an eccentricity about = 1.01, from four obs. rigorously reduced. This orbit was afterwards confirmed by comparison with two other obs." Encke's two orbits were calculated by Olbers' method. On comparison with the obs. he found the errors much greater in a parabola, and stated that they would be increased in an ellipse.—(Z. C., v. 5, p. 557-562.) Mr. A. Graham having examined these orbits by Encke, found that his parabolic orbit was deduced from his hyperbolic, by the corrections in pp. 560-1 of Z. C., v. 5; that the *mark* for seconds of space in "Tems du passage" should be cancelled. In Olbers' List of Comets, edited by Encke, there is an error in the time of P. P. for the parabola, arising, apparently, from his having written .18445, M. T. Paris, instead of .10445. In the same work it is stated that the orbits are referred to M. Eq., January 1, 1771, whereas in Z. C. we read June 1, 1775. The *Is.* have been referred to Equinox of P. P., on the supposition that the latter is correct.

1772.—D. by Montagne, at Limoges, on the 8th March. He observed it but very imperfectly, until the 20th, for want of instruments. The Academy heard of its appearance on the 17th March. Bad weather, however, prevented obs. until the 26th, Messier obs. it on this date—the 27th and 30th March, and on the 3rd April.—(P., v. 2, p. 92.) This comet traversed only 11° . Pingré looked upon the orbit in his time as only a first approximation. On the appearance of the comet of 1805 (2), to which the present bears some resemblance, Burckhardt, Bessel, and Gauss re-computed from the obs. by Messier and Montagne. Burckhardt's orbit is parabolic, and differs essentially from that of the comet 1805 (2). This was also the opinion of Bessel, but assuming the identity which gives a semi-axis major = 10 46544, and an eccentricity = 0.90305; still there remain pretty strong arguments against it. Bessel's ellipse gives a period of 33,856 years. Gauss, supposing the identity, and having applied to this comet the elements which he computed for that of 1805 (2), viz.: a semi-axis major of 2 8222—(Delambre gave 4.7326—the aphelion distance)—found sensible differences, not such as to preclude the identity, but very strong perturbations must have changed the elements.—(D., v. 3, p. 424.) His ellipse gives a revolution in 4.7412 years. There is a misprint in Delambre with reference to Lalande's orbit—February "13" is given in lieu of February "18;" and in M.C. the log P. D. is incorrect.—See note on comets 1805 (2), and 1818 (1). There can be no doubt that this was an appearance of the now celebrated Biela or Gambart Comet.

1773 —D. by Messier, on the 12th October, and obs. by him during six months. Pingré's third orbit was the one he preferred. Lexell vainly endeavoured to determine an ellipse. He found for the eccentricity successively 0.9930757; 0.9951225; 1.0037085, and 1.0024901—thus the two last orbits are hyperbolic. The periods of the former = 2081, and 3527 years respectively. The last, by Pingré, is elliptic. The axis major = 173.11673, and the period = 2269 years. There is, therefore, nothing certain as to the return of this comet; but, should it re-appear, enough is known to identify it. Burckhardt used the obs. of Messier and St. Jacques Silvabella.—(D., v. 3, p. 424.) Pingré, whence the date of discovery was obtained, gave the period from his ellipse = 2279 years, (which is correct, and, therefore, that in Delambre must be a misprint,) and more; Lexell reasonably concluded the impossibility of determining the period; the slightest error in the obs. causing a very considerable one in the duration of the revolution.—(P., v. 2, pp. 92-3.) Messier's memoir is inserted in M. A., 1774, p. 271. On the night of 12th 13th October it was not visible to the naked eye, in a $3\frac{1}{2}$ feet telescope the nucleus was barely discernible. On the morning of 14th October the light seemed to have augmented, and the nucleus was more distinct, without being defined, and surrounded by a nebulosity of

about 4' in diameter, and with a continuity of light to about 8', roughly estimated. The comet was seen by the naked eye with some difficulty. On the morning of the 16th the diameter of nucleus = 47". On the 2nd November there was no sign of train. On the morning of 10th December the nucleus was barely appreciable. Hence, until its disappearance, the light of the comet was always very feeble. Messier annexed to his memoir a chart of the comet's path.

1774.—D. by Montagne, at Limoges, on the 11th August. On the notification given by him to the Academy, Messier sought for it on the night of 17th 18th. He could not find it. The next night he was more successful. he saw it and obs. it almost every night until the 25th October. De Saron computed his first orbit on Messier's obs of 19th August, 11th September, and 1st October. Méchain calculated four orbits consecutively: they differ but slightly. That which Messier finally adopted is the one selected for this Catalogue.—(P., v. 2, p. 93.) This comet was very small, and its apparent motion slow.—(H. A., 1775, p. 37.) Messier's account was published in M. A., 1775, p. 445. He stated that on the night of 18th 19th August it appeared like a small nebula, almost invisible in a $3\frac{1}{2}$ feet telescope of the ordinary description. In an achromatic of the same focal length, with a triple object-glass, the nucleus was seen with difficulty, not defined, and with a slight surrounding nebulosity. On the morning of the 19th, a star was occulted by the comet. During the night of the same day the nucleus = 40" in diameter, the coma, = 5' 56", the former being brilliant and white. The motion being so slow, the obs. are somewhat doubtful. On the 26th September, at $7^h 39^m 42^s$, (true time, Paris,) the nucleus touched a 10th mag star, of which $\alpha = 339^\circ 51' 15''$, $\delta = +23^\circ 18' 0''$. The paper concludes with a collection of obs. from various places, and a chart of the comet's path in the heavens. It is probable that there has been a misprint in both D. and A. J., with reference to the L. P. of Bode's orbit, and that the sign should have been 10 instead of 11.

1779.—D. by Messier, on the 18th January. He observed this small comet from this date, or morning of the 19th, till the 17th May. Méchain from the 30th January to the same date. Saron computed on Messier's obs., Méchain from his own, with which he compared the results. In 52 comparisons the differences in 40 are below 1'. In 11 instances between 1' and 2'. In one the difference reached 2' 1" in L., and in another 2' 4" in l. One can scarcely expect more accurate elements.—(P., v. 2, pp. 94-5.) Pingré gave the preference to D'Angos' orbit.—(D., v. 3, p. 424.) Delambre attributed this orbit to Messier.

1780 (1)—D by Messier, on the morning of 27th October. From this date to the 28th November, or morning of the 29th, he obs. it 14

times. During this interval the apparent motion of the comet was 21° in L., and 22 in l. Méchain followed up his obs. to the morning of 4th December. The first two orbits by Lexell in Delambre's Catalogue are also included in Pingré's. The latter stated that, with reference to the first orbit, the comparisons with Messier's obs. gave the following results.—On 28 obs. the differences were in 26 below $1'$, in one $= 1'$, and in another $= 1' 46''$. The comparisons with the second orbit gave $1' 24''$ for the extreme difference, but in five cases the difference exceeded $1'$. Pingré evidently preferred the elements of Méchain.—(P., v. 3, p. 95–6.) Messier's remarks and obs. are inserted in M. A., 1780, p. 520. On its discovery it was invisible to the naked eye. The centre was pretty bright, surrounded by a nebulosity that seemed slightly to extend in the direction of the circle of declination. On the 1st November it appeared to have increased in brilliancy, and the coma to project towards the West. On the morning of the 5th the nucleus was bright, and on the 7th likewise, but was not defined. Messier estimated its diameter to be $= 8''$, and that of the coma $= 8' 24''$. On the 21st he found that its light had considerably diminished. A chart of its path is appended to his memoir. Clüver's elements were computed by desire of Olbers in 1827.—(A. N., No. 127.) M. Laugier compared his orbit of the comet of 1506 with the elements attributed to Lexell, which are presented in Delambre as his third set; and was of opinion that a strong analogy existed between them.—(C. R., v. 22, p. 155.) Having no authority for this third orbit of Lexell, and also in consequence of its differing from all the others, it has been thought advisable to exclude it from the present Catalogue. The period derived from Clüver's orbit $= 75314$ years!! See note on comet 1827 (3).

1780 (2).—D. by Montagne at Limoges, on the 18th October. Its nucleus was ill-defined. It appeared like a small nebula, a little elongated towards the East, and was invisible to the naked eye. Montagne re-obs. it on the 20th; and no other obs. were known to Pingré.—(P., v. 2, p. 95.) In Messier's memoir he gave the date of discovery as above, and added, "M. Montagne announced his discovery to me in a letter dated the 14th of *same month*" (This must be an error either of day or month.) In a letter dated 22nd December, Montagne added another obs. to those given by Pingré, made on the 26th October, but during only a few minutes of clear sky. Messier suspected that Montagne might have mistaken a cluster of small stars for the comet on this occasion. Messier searched for it several times without success, and said that he had not heard of its having been seen by any astronomer of Europe.—(M. A., 1780, p. 515.) Olbers wrote to v. Zach, under date, Bremen, 30th May, 1799, stating that Montagne's obs. gave a very different orbit from that deduced by Boscowitch, and that there

was no doubt that Montagne really made the obs., as Olbers himself had seen the comet on the 18th October.—(Geograph. Ephem., v. 4, p. 49) Olbers wrote again on the same subject on 1st June, 1801, and in this letter corrected the error in date already remarked. It should be the 24th October.—(A. J., 1804, p. 172.) After reading his statement, it appeared to be useless to include Boscowitch's orbit in the present Catalogue.

1781 (1)—D. by Méchain, on the night of 28th June. He obs. it 12 times, for the last time on the 15th July. It was never visible to the naked eye, and the diameter of its coma did not exceed 3' or 4'. Its southerly motion was very rapid. The elements he computed seem to be very accurate—the difference between calculated and obs. places seldom exceeding 1', and never 1' 30". Pingré called this the *second* comet of this year, but his first proved to be the planet Uranus.—(P., v. 2, p. 98) Delambre erroneously applied to comet (2) of this year what Pingré said of the one under notice. Méchain's elements are given in A. J., 1785, p. 166. Messier's memoir is inserted in M. A., 1781, p. 349. He stated that on the night of the 30th June, that being the date of the announcement of the discovery to the Academy, he found it without difficulty with a telescope of one foot focus. It had no tail, and resembled the beautiful nebula that he had discovered on the 18th March, in Hercules. On the 8th July the nucleus was brilliant, surrounded by a large nebulosity, but without appearance of tail. On the 14th its light was bright, showing, as before, no train. The diameter of nucleus = 9", that of coma = 2' 45". On the 16th its light had sensibly diminished. A chart of the path of this and the following comet is annexed to the memoir. Méchain's paper was published in M. A., 1782, p. 581. This in no way differs from the preceding, excepting as to the obs. places. Méchain added that the comet was obs. by Darquier at Toulouse, and d'Angos at Rouen.

1781 (2)—D. by Méchain, on the morning of the 9th October. At first its apparent motion was very slow, subsequently it became accelerated. It was seen for the last time on 25th December. On the 9th November, at 6½ P.M., its distance from the pole of the ecliptic was only 42', and from the earth = 0.2527. It was then visible to the naked eye, the coma being about 4' or 5' in diameter, and the tail 3° to 4° in length. Méchain's elements well represent all the obs. that unfavourable weather permitted.—(P., v. 2, p. 98.) Messier included his remarks on this comet in the memoir already quoted on the preceding comet. He mentioned that on the morning of the 14th October the nucleus was pretty bright, surrounded by a nebulosity, and with a train of very feeble light, the coma being 4' in diameter, and the extent of the tail = 8' 23". On the morning of the 20th October the light of

the comet increased, the nucleus was faint, and there was no appearance of tail, which might have arisen from a want of clearness in the atmosphere. On the 4th November the nucleus was very small, the nebosity large. On the 6th, Messier unfortunately got a tremendous fall, which put an end to his obs. for a year. Méchain's remarks are also included in the memoir quoted for the preceding comet. He stated that on the 7th November the tail = 3° or 4° in length; the coma being = $20'$ in diameter, and the nucleus bright, but not defined. On the 17th the tail appeared to be several degrees in extent. On the 10th December the comet was still visible to the naked eye, and the tail seemed to be about 3° in length. Méchain added that this comet was obs. by Darquier at Toulouse, Pigott at York, and Kohler at Dresden. Mr. Pigott's comet had a coma of 5 or 6 minutes in diameter.—(P. T., 1802, p. 227.)

1783.—D. by Pigott, at York, November 19th. His first obs. was made at $11^h 15^m$, P.M., of that day. He again saw the comet on the 20th and 21st November. At the latter date it looked like a nebula, with a diameter of about $2'$ of a degree. The nucleus being very faint, was seen, with some difficulty, when the wires of the instrument were illuminated.—(P. T. Ab., v. 15, p. 464.) After obs. made by Mr. Pigott up to December 3rd, inclusive, he repeated that the comet had exactly the appearance of a nebula; its light was so faint that it could not be seen in a good opera glass. In the night telescope the nucleus was scarcely visible, and the diameter of the surrounding coma was about $3'$ of a degree. Between November 19th and 26th it rather diminished in brightness. December 1st and 3rd it was very difficult to be seen, occasioned, perhaps, by its little elevation above the horizon. Between December 3rd and 10th the comet was entirely effaced by the increased light of the Moon.—(P. T. Ab., v. 15, pp. 621–2.) This comet was invisible to the naked eye, without tail, and of very faint light. It was difficult to illuminate the wires without obliterating it. Pigott, in transmitting his obs. to Méchain, stated that its error might be half a minute in right ascension, and two minutes at the utmost in declination. Goodrick obs. it at York also, on the 24th. It was often obs. at Paris by Méchain, from 26th November to the 21st December, and by Messier from 27th November to same date. De Saron, Messier, and d'Angos computed its orbit. They were unable to obtain one which fully represented the obs., probably on account of the difficulty of observing it. From Méchain's elements it appears that this comet passed as near as possible to the earth, and, nevertheless, it was extremely difficult to obs. it. We may conclude that it may often come to its perihelion without being seen; the same is probably the case with a considerable number of other comets.—(P., v. 2, p. 511–2.)

Méchain's memoir appears in *M. A.*, 1783, p. 643. He first saw it on the 26th November, and stated that it was very faint, with a diffused nebulosity, and without visible nucleus—unless a central light, somewhat brighter than the rest, deserved the name—no sign of tail, and the diameter of coma not exceeding $1' 30''$. Bode published a letter addressed to him by Méchain, in which he stated that Pigott saw the comet for the last time on the 3rd December — (*A. J.*, 1787, p. 142) We have no Notes on Burckhardt's orbits, and have thought it advisable to omit that which Delambre printed as Méchain's second, inasmuch as it is only the preceding given to minutes; and the last orbit in Delambre's Catalogue has been set aside in consequence of its considerable variation from all others. The period deduced from Burckhardt's first orbit = 5.6134 years, and that from his second = 10.0260 years. It will be perceived from the preceding statement that Pingré was not aware of Pigott's obs. of 19th November. It is also stated in the *P. T.*, 1802, p. 227, that this comet had a coma of $8'$ in diameter

1784 (1) — D. unknown. La Nux informed Pingré by letter from the Isle of Bourbon, that this comet was seen there from the 15th December, 1783. He did not, however, obs. it himself until the 3rd January, 1784. It could not then be seen in Europe, its declination being too far south. It was detected at the Cape of Good Hope on the 10th January, at Guadaloupe on the 16th, and at Malta on the 20th. Pingré said that the obs. by d'Angos in this island would, no doubt, afford much facility for the determination of good elements. Cassini jun., and Méchain obs. it in Paris on the 24th. Méchain got seven obs. in February, and another on the 1st March. Messier, in addition to several in February, and at the beginning of March, also obs. it on the 11th of that month. During the earlier part of its visibility at Paris it was tolerably fine, and with a *head* of $33''$ in diameter, the tail being from 2° to 3° in length, and it was easily seen by the naked eye. Pingré stated that Méchain only gave his first orbit as approximative, and merely deduced from it that the comet would reappear after conjunction with the Sun, in the month of May. Such turned out to be the case, and Méchain obs. it from the 9th to the 21st; Messier till the 26th. During this period its light was extremely feeble. — (*P.*, v. 2, p. 512-3.) The preceding remarks have induced the rejection of Méchain's first orbit (the second given by Delambre) from the present Catalogue. Messier's paper is to be found in *M. A.*, 1784, p. 313. He stated that on the 24th January its nucleus was about $30''$ in diameter, and the length of its tail about 2° . On the 3rd February he found the diameter of nucleus = $40''$, and it was bright. The diameter of the coma = $1' 31''$. On the 10th the comet was visible to the naked eye, with a tail $2^\circ 30'$ long, but very faint; the

nucleus was bright. On the 29th a suspicion alone existed of a feeble train; and on the 1st March there was no appearance of a tail. After its conjunction its light was always very faint. Méchain's memoir is inserted in *M. A.*, 1784, p. 358. There seems to be little difference between his account and that of Messier. He stated that his first orbit was founded on his own obs. of 24th January, 3rd and 14th February, and that his second (that given in the present Catalogue) was checked by his entire series of obs. He added that this comet was obs. by Darquier at Toulouse, by the Abbé de Beauchamp at Bagdad, and also at Bussora. See *A. J.*, 1787, p. 143.

1784 (2) ?—It has been with no slight misgivings that this so-called comet has been introduced into the present Catalogue at all. It is but right, therefore, to premise that de Zach declared it to have been a gross astronomical imposition, which was exposed by Encke, and attributed to the Chevalier d'Angos. For this exposé the reader must be referred to *Z. C.*, v. 4, p. 456. All that it appears necessary to extract from the paper is, that d'Angos professed to have obs. it on the 10th, 14th to 18th, 22nd, 23rd, 25th, 26th of April, and from the 28th to the 1st of May inclusive; and that the conclusion arrived at by Encke was, that the comet had in fact no existence!! After this cautionary preface we may proceed to the usual Note, which will be found to be considerably opposed to Encke's statement. D. by d'Angos, at Malta. He wrote to Messier to say that he had detected it in *Vulpecula*, on the 11th April; that it was very small, without a tail, and with only a slight appearance of nebulosity. Two obs. are not sufficient to complete the orbit. Perhaps d'Angos may have obtained others. Messier received the letter from d'Angos on the 14th May, and fruitlessly sought the phenomenon—(*P.*, v. 2, p. 513-4.) D'Angos only obs. it twice, so said Delambre. Burckhardt at first assumed that its distance from the earth was the same at both obs., and afterwards that the distance had diminished one-fifth. That all is uncertain is evident. Some resemblance has been thought to exist between this and the comet of 1580—(*D.*, v. 3, p. 425.) In de Zach's remarks on Burckhardt's orbits of old and recent comets, he mentioned that d'Angos observed the one under consideration on the 10th and 14th April, whereas Pingré gave the 11th April for the date of the discovery, and this extracted from a letter of d'Angos himself. De Zach recognised a similitude between Burckhardt's second elements and those of the comet of 1850. Unfortunately d'Angos lost all his papers descriptive of the comet, in a fire, by which the Observatory in Malta was destroyed. The only fragment concerning it which was saved, was a note in his meteorological journal, stating that he had searched for it without success on the 22nd April; and Burckhardt remarked that such a

failure was a fact in opposition to both of his orbits. He then computed his third elements to meet this circumstance.—(M. C, Band 16, p. 513.) Delambre quotes M. A., 1806, which we do not possess. Having laid before the reader both sides of the question, he must exercise his own judgment.

1785 (1).—D. by Messier and Méchain, on the 7th January. The latter stated that he computed his orbit from the whole of his obs. The former obs. it from 16th January to 8th February —(A. J., 1788, p. 166.) Messier's memoir is to be found in M. A., 1785, p. 639. He said that in a telescope it appeared like a white spot, pretty large, and with a centre more luminous than the rest of the nebosity. On the 9th the comet seemed somewhat brighter than on the 7th, the nucleus more distinct than the surrounding coma, but there was no appearance of tail. It was invisible to the naked eye. A chart of its path is annexed to the memoir, with a representation of Cetus, "very like a whale."

1785 (2).—D. by Méchain, on the 11th March. It was not then visible to the naked eye, but in the telescope its light was very vivid, like a star of 3rd or 4th mag., without tail, and almost without nebosity. On the 30th it was seen with the naked eye, and had a pretty long tail. On the 4th April the train was 5° in length, and the nucleus very brilliant. On the 6th the diameter of nucleus = $25''$, and it was pretty sharply defined. On the 12th the tail was broader, and the diameter of the nucleus increased —(A. J., 1789, p. 143.) Messier's paper on this comet may be consulted in M. A., 1785, p. 646. He mentioned that on the 13th March the nucleus was brilliant, surrounded by a nebosity, but without tail; that on the 5th April the train extended over 7° or 8° , as also on the 6th. On the 7th the diameter of nucleus = $14''$, that of the coma = $3' 41''$, and the tail = 8° in length. He added, that de Saron's elements approached nearly to the true orbit of the comet.

1786 (1).—This is the first known appearance of the now celebrated "Encke's Comet." D. by Méchain, on the 17th January, who, on the following day, announced its appearance to Messier. The latter, from various impeding causes on the 18th, did not find it until the evening of the 19th. It seemed to be pretty large, rather well defined, and with a bright nucleus enveloped in nebosity, and without any sign of train. Messier concluded his memoir by saying, "I have not learnt that this comet was obs. elsewhere than in Paris; thus we have only two obs., which do not suffice to determine its elements, unless, indeed, some obs. should be received from other places."—(M. A., 1786, p. 95.) The orbit by Encke, introduced into the Catalogue, was taken from Olbers' Catalogue, at Naples. No information was annexed as to the

data from whence it was derived. De Zach stated that Burckhardt was mistaken in saying that only two obs of this comet were secured, for that Méchain obs. it on the 19th as well as on the 17th. Thus the first obs. was by Méchain, on the 17th, the second by Cassini and Messier, on the 19th, and the last by Méchain, on the same night. From what de Zach said in his paper, it is presumable that the orbit given was *retrospective* or deduced from elements computed from obs. made at subsequent apparitions, and varied to meet, as much as possible, the two or three obs in 1786. See Z C., v. 2, p. 606 We have made, if right in this opinion, an exception to our rule, not to admit into the present Catalogue other orbits than those deduced directly from the obs made during the apparition named. See comets, 1795, 1805 (1), 1819 (1), &c.

1786 (2).—D. by Miss Caroline Herschel, at Slough, on the 1st August—(M A, 1786, p 98.) Messier justly describes her in this memoir as the "sister of the celebrated observer to whom we owe our knowledge of the planet which bears his name, and who has enriched astronomy much with the large instruments constructed by himself." M Blagden, in announcing the discovery to the French Academy, stated that the comet appeared on the 1st August, like a nebulous spot. Messier found it on the evening of the 11th. In an achromatic telescope, of 40 inches focal length, and 40 lines aperture, the nucleus appeared to be surrounded by a great nebulosity, without any indication of tail. It was not visible to the naked eye. On the 18th the tail extended to $1^{\circ} 30'$. On the 19th the comet and the nebula between Canes Venatici and Bootes were in the field of the telescope together; the distance between their centres being only $6' 45''$ in declination. They were similar in form, light, and size, the comet being somewhat the most apparent. On the 23rd there was merely the suspicion of a tail, as also on the 24th, when the nucleus was bright, with a large nebulosity. On the 6th September it was well seen, notwithstanding the Moon, with brilliant nucleus surrounded by coma. On the 9th it had lost much of its light. On the 11th its extent was diminished, but it had considerable light. After this date Messier departed for the Chateau de Saron, where he continued his obs. On the 16th September the comet seemed to have lost much light since his preceding obs. on the 11th; but the nucleus was pretty well shown, with a slight circumjacent nebulosity. On the 21st the nucleus formed a brilliant point of light, with some extent of coma. It was seen with difficulty on the 1st October, and Messier made his last obs. on the 26th. A chart of the comet's path is annexed to his memoir. Miss Caroline Herschel stated, that in sweeping for comets in the neighbourhood of the Sun, at about 10 P.M. of August 1st, 1786, she found an object very much resembling

in colour and brightness the 27th nebula of the *Coun. des Tems.*, with the difference, however, of being round. She suspected it to be a comet; but a haziness coming on, it was not possible for her entirely to satisfy herself as to its motion till the following evening. With reference to the letter written by Miss Herschel on this discovery, Dr. Herschel said that he wished to add the following remarks—"The first view I had of the comet, after my return from Germany, was the 19th August, when with a ten feet reflector it appeared not much unlike the third nebula of the *Coun. des Tems.*, with which it might be very conveniently compared, on account of its proximity. It was, however, considerably brighter, and seemed to have a very imperfect and confused kind of gathered light about the middle, which could hardly deserve the name of a nucleus. It had also, besides a diffused coma, a very faint, scattered light, towards the N. following parts, extending to about 3 or 4 minutes, and losing itself insensibly"—*P. T. Ab.*, v. 16, pp. 169-70.) The Rev. F. Wollaston stated that during the whole time the comet was invisible to the naked eye, and without any tail. That its appearance was so very similar to the nebula No. 3 in Messier's Catalogue, as scarcely to be distinguished from it when in the telescope together; though it certainly had a brighter spot in the centre.—(*P. T. Ab.*, v. 16, p. 186.) See *C. T.*, 1789; obs. by Maskelyne, 1786; *Ephem de Milan*, 1789; works to which we regret that we have not access at present.

1787.—D. by Méchain, on the 10th April. Messier found it on the 11th, almost immediately, but it was visible only through a telescope. Its nucleus was pretty luminous, enveloped in a small nebulosity, and it showed very little sign of tail. He gave a celestial chart, in which are noted all the positions obs. by himself, together with the first by Méchain, and two others obtained at Toulouse by Darquier, on the 22nd and 23rd April. He added that the elements were computed by de Saron from Méchain's obs. and from some of his own.—(*M. A.*, 1787, p. 70) See *C. T.*, *1791.

1788 (1).—D. by Messier, on 25th November. It was not visible to the naked eye. In the telescope it was pretty lustrous, with a bright nucleus surrounded by coma, with a train from 2° to 3° in length; but of very feeble light. The severity of the cold caused the coagulation of the oil of the clock, which was hence frequently stopped. On the 27th, the comet appeared to be somewhat brighter than on the 25th. On the 28th Messier was convinced of its increase in light, and the nucleus became more evident, with coma and indication of a very short tail. On the 30th it was seen with the naked eye. On the 14th December he remarked a diminution of its light, still the nucleus was brilliant, with slight nebulosity, sufficiently elongated to show the direction of the train, which was very faint. On the 16th the light

had further decreased. He continued to obs. it up to the 29th December. Méchain computed his first orbit from Messier's obs.—(M. A., 1789, p. 663.) His second orbit appears to have been founded on his own obs.—(A. J., 1793, p. 118.)

1788 (2).—D. by Miss Caroline Herschel, on the 21st December. On the 3rd January, 1789, the announcement reached Messier, and in the evening he fruitlessly sought it. At about 3 A.M. of the 4th, he descried a small collection of light, of extreme faintness, without symptom of nucleus or tail. Again it was with much difficulty that he perceived it on the morning of the 5th, and also on that of the 7th. He resigned his pursuit of it on the 12th, having obtained obs. on only two days. He mentioned, however, that Miss Herschel and Maskelyne obs. it in England, and Méchain in Paris, on the 15th and 18th January. He stated that he annexed to his memoir a chart of the comet's path, but which is not contained in our copy. He also gave Méchain's orbit—the second in Delambre—(M. A., 1789, p. 681.) Dr Herschel stated that in his instrument, which was a ten feet reflector, it had, on the night of December 21st, the appearance of a considerably bright nebula, of an irregular, round form, very gradually brighter in the middle, and about five or six minutes in diameter. On the following night and several evenings afterwards, he viewed the comet again with such powers as its diluted light would permit, but could not perceive any sort of nucleus, which, had it been a single second in diameter, he thought could not well have escaped him.—(P. T. Ab., v. 16, p. 560.) See Phil. Trans., v. 77, and Maskelyne, 1788.

1790 (1).—D. by Miss Caroline Herschel, on the 7th January. Messier heard of the discovery through Méchain on the 18th. On the evening of the same day, he sought for it without success. He detected it on the 19th, uncertain, however, until the following night whether or not he had mistaken a nebula for it. This comet was obs. on the 21st, by Cassini and Méchain, but was not visible to the naked eye, nor to be seen without a good telescope. It looked like a small compact nebulosity, in the centre of which there was a stronger light, and it might have been compared to the nebula between the heads of Pegasus and Equuleus. This comet seemed to have double the light of the second of this year, which was in view at the same time. Messier obs. it only on the 9th (? 19th) and 20th January. Saron selected for the calculation of his two orbits an obs. made at Slough, on the 9th January, that of Messier on the 19th, and (the mean probably of) those by Cassini and Méchain on the 21st. Messier considered them to be sufficiently good for the purpose of identifying the comet on any future return.—(M. A., 1790, p. 309.) A celestial chart is attached to the preceding memoir, showing the apparent route of the phenomenon.

It traversed about 18° of a great circle, in 12 days. Dr. Herschel mentioned that this comet was surrounded by a haziness of 5 or 6 minutes in diameter.—(P. T., 1802, p. 227) Saron's 2nd set of elements is given as quoted in Catalogue. See C. T., 1792. The second orbit given was the first computed.

1790 (2)—D. by Méchain, on 9th January, who announced it to Messier on the following morning, giving him two places of the comet. Messier found it with difficulty on the night of the 10th, owing to the faintness of its light. It had about the same appearance as that discovered by these astronomers on the 7th January, 1785. On the 11th Messier could only see a confused nebulosity, without any indication of nucleus, owing to a hazy atmosphere. On the 13th it was very faint, and on the 16th still more so. On the 19th he obs both this and Miss Herschel's comet. His last obs was on the 22nd. Méchain computed his orbit on the entire set of obs made by himself. A chart of this comet's path is appended to his paper—(M. A., 1790, p. 309) Dr. Herschel said that the coma of this comet was similar in diameter to that of the preceding.—(P. T., 1802, p. 227.) See A. J., 1794, and C. T., 1792

1790 (3)—D. by Miss Caroline Herschel, on the 18th April. Maskelyne communicated the discovery to Méchain, and the latter to Messier on the 30th. On the night of 1st May, Messier found it in the parallel of the well-known nebula of Andromeda. In the telescope the comet appeared as brilliant as the nebula. The nucleus was bright, and surrounded by a large nebulosity, with a prolongation of train. Messier thought that he might have seen it with the naked eye. On the night of the 4th May, the comet showed considerable light, its nucleus was distinct without being defined, with coma as before, and showing a tail. On the 11th the tail seemed wide. On the 17th the object was visible to the naked eye, and appeared to have increased in brightness, the train being about 2° in length. On the 20th the tail had extended to 4° , the appearance of the rest of the phenomenon being as before. On the 22nd its light had still more augmented, but haze prevented any measure of its tail. On the 23rd, the same. On the 2nd June the diameter of nucleus = $6''$, that of the coma = $5' 23''$. On the 4th, the light of the tail was very strong. On the 20th Messier was satisfied that the comet had decreased in brilliancy since the 16th, the tail being almost invisible. According to him, the comet was obs from 1st May to 29th June, in which period he made 43 obs. Méchain computed his orbit upon the data acquired by himself.—(M. A., 1790, p. 320.) A chart of this comet's path is annexed to Messier's paper. See A. J., 1794, p. 94.

1792 (1).—D. by Miss Caroline Herschel, on the 15th December,

1791. Bode found it on the 13th January, after it had traversed about 38° southward. It appeared as a faint nebula, and the light was so feeble that he could only see it with his best achromatic telescope. It passed through the plane of the earth's orbit on the 1st February. On the day of its discovery it was 85 millions of miles from the earth, and on the 19th January it was distant 160 millions of miles, which accounts for its faintness. Had it had a tail it could not have been visible from the earth, as it must have extended in an opposite direction—(A. J., 1795, p. 184.) Méchain obs. it from 25th December, 1791, to 19th January, 1792. Messier, a few days later, and Maskelyne on the 25th January, which Méchain believed to have been the last obs. Darquier, at Toulouse, and St. Jacques, at Marseilles, sought for it in vain on the 10th February, at the request of Messier. It was then at its descending node. Messier also searched for it at the same time, but in unfavourable weather.—(A. J., 1795, p. 199.) The orbit of Méchain was corrected upon the whole series of obs.—(D., v. 3, p. 425.) De Zach's elements were founded on obs. of 17th, 19th, 25th, 26th, and 27th December, 1791—(A. J., 1796, p. 147.) Méchain's orbit, given in the present Catalogue, was founded on his own and Maskelyne's obs—(A. J., 1797, p. 122.) The second orbit attributed to Méchain, by Delambre, is the one which was at first computed, and as, in addition to this fact, the P. D. and log P. D. do not agree, we have omitted it. See C. T., 1793, and Englefield.

1792 (2).—D. by the Rev. E. Gregory, in the evening of January 8th, 1793. It was of a dull hazy appearance, its shape rather oval, a faint appearance of a tail, but no perceptible nucleus.—(P. T. Ab., v. 17, p. 294.) D. also by Méchain on the 10th January, 1793.—(O. S. A., p. 52.) Saron's orbit is only an approximation—(D., v. 3, p. 425.) For this reason it has been now omitted. Prosperin stated that he founded his orbit upon the obs. given in Part I of the Phil. Trans. for 1793; the two first of which were by Gregory, the third by St. Lee, and the rest by Maskelyne. He added that his elements agreed with Maskelyne's obs., but that they differed $3'$ in l. and $10'$ in L. from those of Gregory, and $42'$ in l. and $2^{\circ} 20'$ in L. from that by St. Lee.—(A. J., 1799, p. 192.) See Piazzi's Spec. Astron., and C. T., 1795.

1793 (1).—D. by Messier or Méchain, on 27th September. Bode stated from C. T., 1795, that Méchain was the discoverer.—(A. J., 1798, p. 243.) In a note to A. J., 1797, p. 136, Bode gave the discovery to Messier. Query, Messier or Méchain a misprint. See Phil. Trans., 1793. There is no further information in the Library of the Markree Observatory.

1793 (2).—D. by Perny, on the 24th September, the authority being C. T., 1795.—(A. J., 1798, p. 243.) We have no account of this

comet. Burckhardt's orbit gives a period of 12.127 years. It was also detected by Miss Herschel on the night of 7th October, and obs. on the following night by Dr Herschel.—(P. T. Ab., v. 17, p. 335)

1795—The second known appearance of Encke's comet. D. by Miss Caroline Herschel on 7th November.—(A. J., 1814, p. 171.) She remarked that the diameter of the comet, on this evening, was about 5'. That it had no kind of nucleus, and had the appearance of an ill-defined haziness, which was rather strongest about the middle.—(P. T. Ab., v. 17, p. 698) Detected at Berlin, on the 11th November, between Lyra and Cygnus, and found by Olbers, on the 19th, in Hercules. On the 21st the comet would not bear an illuminated field, and he was obliged to compare it with stars in the same parallel by noting the times of transit across the field of view. It was round, badly defined, and without a distinct nucleus. On this date it was about 3' in diameter. Olbers' first orbit was founded on Bode's obs., of 13th November, and his own, of 21st and 27th November. He thought that the comet might have been seen with the naked eye before the 11th November.—(A. J., 1799, p. 100) The little agreement between the orbits given of this comet led Olbers to new researches. He preferred the earlier of his last two sets of elements.—(D., v. 3, p. 425) Prosperin, in writing to Bode, remarked that it was unfortunate that he had not given him the Berlin obs. more correctly, and that, consequently, he only considered his orbit an approximation. Compared with Bode's obs. of 11th, 18th, and 24th November, it shows differences, in all cases, amounting to 4', and he stated that no parabolic orbit would agree with the obs.—(A. J., 1799, p. 191.) No wonder, when it was subsequently ascertained to have been an apparition of the celebrated comet of shortest period. The orbit by de Zach and Burckhardt, (erroneously attributed, by Delambre, to de Zach alone,) rested on Olbers' obs. of 21st, 22nd, and 27th November. De Zach complained of the difficulty of obs. this comet, on account of its faintness, and refrained from publishing three obs., made by himself, lest he should confuse calculators.—(A. J., 1799, p. 204.) Olbers stated that Prosperin's orbit was worthless, for the reasons already given herein. The I., in Bouvard's elements, is misprinted. It should have been $20^{\circ} 3'$ instead of $10^{\circ} 3'$. Olbers remarked that Bouvard computed from his own obs., and that the difference between his first orbit and that by de Zach and Burckhardt arose from the fact, that different authorities were referred to for the obs. of 13th November, and neither of the authorities proved to be correct. The place of the comet, on the 7th November, was only *estimated* by Sir W. Herschel. Maskelyne obs. it on the 20th, 21st, and 24th; but Olbers thought that the places of the stars with which he compared the comet, on these

three nights, were not well determined. Olbers' second orbit was founded on Sir W. Herschel's obs. of 9th November; Bode's, of the 13th; and his own, of the 27th. His third orbit resulted from his adoption of Bode's obs. of 18th November.—(A. J., 1814, p. 169.) The information obtained has induced the omission from the present Catalogue of Bode's first elements, and those of Bouvard, de Zach, Burckhardt, and Prosperin. See C. T., An. VI., and Z. C., v. 2, pp 502-5, and 602. Encke's ellipse gives a period of 3.294 years.

1796.—D. by Olbers, on 31st March, near 69 Virginis. On the night of the 1st April it covered the star 53 Virginis, which is of the 7th mag., the diminution of the light of the star being scarcely perceptible. The comet was very faint, but, as it rose in the heavens, and receded from this star, Olbers could occasionally see a small nucleus. It would not bear illumination. On the 2nd he saw the comet, but an obs. was impossible. From this date to the 14th he obs it several times. It was barely visible on the 14th, it being bright moonlight. He sought for it on the 23rd, before moon-rise, but unsuccessfully, and considered it to have been the faintest comet that had appeared. His orbit was founded on the obs. of 31st March, 7th and 12th April.—(A. J., 1799, p. 100)

1797.—D. by Bouvard, on the 14th August. It was also discovered on the night of the 15th, by Rudiger, at Leipsic, and on the 16th, by Kecht, at Berlin. Rüdiger stated that it appeared round and nebulous in the telescope. Bode said, that, on the 21st, it would not bear any illumination. It was much fainter than it had been a few days before, and nearly resembled a very faint nebula without any definite outline. On the 24th he again saw it, having so little light that he could not determine its place. On the 26th he was similarly circumstanced, could not trust obs. made with a circular micrometer, and had to content himself with estimating its place by comparison with neighbouring stars. On the 29th he saw it for the last time.—(A. J., 1800, p. 233.) Walker, in London, saw two stars through the coma. Olbers estimated the diameter at 4500 geographical miles, its shortest distance from the earth was $= 0.088$ —(D., v 3, p 425.) Bode's orbit was computed from Bouvard's obs. of 14th August, and his own of 21st and 28th. Walker remarked that, on the 18th, the comet resembled the great nebula in Andromeda.—(A. J., 1801, p. 100) Olbers stated that, from the 14th to 20th August, it was visible to the naked eye. He obs. it from the 21st to the 29th. His two orbits were founded on the obs. of 14th, 21st, and 29th. With reference to the earth, this comet approached it, on the 16th, almost as nearly as it could, considering the circumstances of the respective orbits. At this date Professor Tralles estimated its diameter at from 7' to 10'. On the 19th,

measures were obtained in England. The nucleus was $= 2' 40''$ and the entire nebulosity about $= 5'$ in diameter. On the 21st Olbers estimated the diameter at $3'$, and added that, throughout the period of its visibility, there was no sign of a solid nucleus.—(A. J., 1801, p. 163.) Flaugergues detected it on the morning of the 17th August, in Ursa Minor, appearing like a small white cloud, irregularly surrounded, without apparent nucleus or tail. Its motion was extremely rapid.—(Z. C., v. 7, p. 220-1.)

1798 (1).—D. by Messier, on 12th April, who obs. it from this date to the 24th May.—(A. J., 1801, p. 230.) The 21st discovery by Messier since 1758, and the 41st comet that he had obs.—(D, v. 3, p. 426.) There are three orbits by Burckhardt in *Ephem. Geograph.* v. 1, p. 690, but not the one introduced into Delambre's Catalogue. This latter appears to have been computed from Messier's obs. up to the 6th May. The calculated place from this orbit differs from the obs. of the 10th May in $L. = 14''$ and in $l. = 24''$. *Ephem. Geograph.* v. 2, p. 79. In A. J., 1801, p. 231, the names of the computers, Burckhardt and Olbers, should be interchanged —(Olbers' *Abh.*, p. 217)

1798 (2).—D. by Bouvard, on the 6th December, and by Olbers on the 8th. De Zach remarked that on the 7th December $10''$ error in the Sun's place would cause $2'$ error in the geocentric place of the comet. It was in this year that d'Angos thought that he had seen a comet pass over the disc of the Sun.—(D., v. 3, p. 426) It appeared like a small cluster through Olbers' *cometen-sucher*, but on using his large telescope he ascertained that the cause of this appearance arose from some small stars seen through the nebulosity. He said that on the 10th December, it resembled a faint undefined nebula; and he saw it for the last time on the 12th. His orbit was founded on the obs. of the 6th, 9th, and 11th December, and it agreed closely with all the obs. No trace of a nucleus in his five feet Dollond; it was merely a little brighter in the centre, however, Schröter with his thirteen feet, Harding with his seven feet, and also Méchain perceived a small nucleus of $2''$ diameter, which, Olbers remarked, would be equal to 27 geographical miles.—(A. J., 1802, p. 195.) Burckhardt's orbits were computed from Messier's obs. of 7th, 9th, and 11th December. He gave the preference to his first elements.—(*Ephem. Geograph.* v. 3, p. 397) See C. T., 1804.

1799 (1).—D. by Méchain, on the morning of 7th August, and found by Olbers on the night of the 26th. He stated that it was small, but very vivid. His orbit was computed from Messier's obs. of the 10th and 23rd August, and de Zach's of the 8th September. He gave great credit to Méchain for its discovery at a time when the comet's distance from the earth was above one and a half time the mean radius of the

earth's orbit.—(A. J., 1803, p. 101.) The diameter of nucleus = $4''.32$, according to Schröter. De Zach remarked that an error of $8'$ in an obs. would produce a similar error in I.—(D., v. 3, p. 426) Méchain stated that it was exceedingly faint when discovered, and that it gradually approached the earth until its distance decreased to about three-quarters of the earth's distance from the Sun. At the end of August and beginning of September it was just visible to the naked eye. In the telescope it exhibited some trace of a tail, about 1° in length. Méchain said that this was his tenth discovery, the twenty-first comet which he had obs. accurately, and the twentieth whose orbit he had calculated.—(A. J., 1803, p. 171.) Bode obs. this comet on the 26th, 28th, 30th, and 31st August, and on the 1st, 5th, 7th, 10th, 12th, 15th, and 25th September. His orbit was deduced from Méchain's obs. of the 7th August, and his own of the 31st August and 25th September. He gave it merely as approximate.—(Same vol., p. 253.) Schröter attributed to this comet a solid planetary nucleus, the diameter = $3''.69$, if seen from a distance equal to the mean distance of the earth from the Sun, which would = 373 geographical miles. Its spherical nebulosity extended at P. P. to a diameter of 21797 miles, and the tail increased to the extent of 604792 miles. In his twenty-seven feet reflector the nucleus showed magnificently, on the 6th September, like a planet surrounded by a nebulous atmosphere. He said that it had an atmosphere more immediately connected with the nucleus than with the surrounding nebulosity, and that this appeared to enlarge as it approached the Sun, and to become more or less transparent at different times. This atmosphere increased so much that it nearly obscured the nucleus on the 18th October. On the following evening it cleared away.—(Same vol., p. 201.) The length of the paper, from whence the preceding extracts have been taken, quite precludes its admissibility into these notes, but it is of sufficient interest to be read with profit. Littrow's elements were founded on the obs. of 30th August and 2nd and 4th September, taken from C. T., An. 12.—(A. J., 1812, p. 184.) The approximate orbit by Bode, as well as this by Littrow, computed on a very small arc, have been excluded from the present Catalogue. Dr. Herschel says concerning this object, Mr. Stephen Lee's comet had a coma of not less than $10'$ in diameter, and also a tail of $15'$ in length.—(P. T., 1802, p. 227.)

1799 (2).—D. by Méchain, on the morning of 26th December. As soon as he perceived it in the telescope he remarked that it was as visible to the naked eye as a star of 4th or 5th mag. In his achromatic, with a magnifying power of 30, the nucleus, though small, appeared very bright and sharply defined. It had a narrow but distinct tail, of about 1° in length. On the following day the nucleus seemed larger,

and the tail had increased to from 2° to 3° . On the 5th January, 1800, the tail had a marked curvature, particularly near the nucleus. The concave edge of this curvature was turned towards the Sun. He obs. only on six different days, between 26th December and 6th January. On the last day it was pretty well seen by the naked eye, and showed slight traces of a tail. His elements were founded on his own obs., which only embraced an arc of $12^{\circ} 20'$ in l. and $1^{\circ} 58'$ in L.—(A. J., 1803, p. 175.) Méchain thought that it might be identical with the comet of 1669—(D, v. 3, p. 426.) In the month of February, in this year, the populace expected, with superstitious anxiety, the appearance of a comet of which astronomers knew nothing.

1801.—D. by Reissig, jun., of Cassel, on the 30th June, when it was between the head of Ursa Major and Camelopardalis—(Note to A. J., 1805, p. 128-9.) Detected nearly at the same time by Pons, Messier, Méchain, and Bouvard.—(D., v. 3, p. 426.) Bode stated the three last-named astronomers found it on the 12th July, in Ursa Major, and that it was small.—(A. J., 1804, p. 266.) Méchain was doubtful for some time whether it was a comet or a nebula. Messier told him that he had not seen it later than the 23rd July.—(A. J., 1805, p. 128-9.) Burckhardt computed his elements from the Paris obs., extending over only 10 days.—(A. J., 1809, p. 272.)

1802.—D. by Pons, at Marseilles, on the 26th August, by Méchain, at Paris, on the 28th; and by Olbers, at Bremen, on the 20th September. The nucleus was almost imperceptible. Olbers saw a star of 10th magnitude through it, without any diminution of its light. Méchain explained this by a double refraction.—(D, v. 3, p. 426.) He also said that it was not visible to the naked eye. The surrounding nebulosity was diffused and faint, a little elongated, but showed no sign of tail.—(A. J., 1805, p. 229.) It appears from a letter written by Olbers, under date 4th September, that there is a misprint in Delambre of the date of Olbers' discovery, and that it was on the 2nd not 20th September. Olbers stated that it was of faint light, like an ill-defined nebula, and of about $3'$ diameter, being somewhat brighter in the centre.—(A. J., 1805, p. 232.) Harding saw, on the 5th September, a small bright point in the centre, which was very badly defined in his thirteen feet telescope. There appeared to him to be something like a tail extending to the eastward, but strong moonlight prevented his being certain of its existence.—(A. J., 1805, p. 257.) Bode saw it on the 20th September, and confirmed the description given by others.—(A. J., 1805, p. 266.) Méchain obs. it from the 28th August to the 3rd October.—(A. J., 1806, p. 129.) Olbers stated that the diameter of the nebulous atmosphere exceeded five semi-diameters of the earth. (M. C., v. 6, p. 380.) He obs. it until the 2nd October, and calculated

his third orbit (that given in the Catalogue) from his own obs. up to 30th September—(M. C., v, 6, p. 506-7.)

1804.—D. by Pons, on the 7th March, on which day it reached its brightest degree.—(A. J., 1806, p. 133.) It was without nucleus or tail—(D., v. 3, p. 426) Olbers saw it first on the 12th March. It was more striking and brilliant than the nebula in Mons Mænalus. On the 13th it was very distinct in his cometen-sucher, but pale and confused in his achromatic. On the 28th a small nucleus was occasionally perceptible. He appears to have seen it for the last time on the 1st April. He said that Gauss' elements agreed better with the obs. than Wahl's. He could see no distinct nucleus, nor a trace of a tail. The diameter of the nebulosity, as estimated by him, was about six semi-diameters of the earth.—(A. J., 1807, p. 229, &c.) It was discovered by Bouvard, on the 10th March.—(M. C., v. 9, p. 433.)

1805 (1).—Third known appearance of Encke's comet. D by Thulis, of Marseilles, on the 19th October.—(M. C., v. 13, p. 194) Detected by Bouvard and Pons on the 20th October, and afterwards by Huth.—(D., v. 3, p. 426.) Huth stated in a letter to de Zach, under date the 22nd October, that on the morning of the 20th he estimated the apparent motion of this comet to be about 3° daily, in a S E direction. It was visible to the naked eye, but very faint, while it was well seen through a common telescope. It very much resembled the great nebula in Andromeda in extent, hue, and brilliancy; excepting that it was almost circular, and more sharply defined on the N. edge than elsewhere. On the 22nd it appeared rather larger and brighter than on the 20th. In another letter, dated 27th October, he remarked that it had traversed 16° in five days.—(M. C., v. 12, p. 499, &c.) Bessel's orbit was computed from Olbers' obs., and one sent to him by Bode—(M. C., v. 13, p. 80.) (A. J., 1809, p. 135) Legendre's orbit agrees very fairly with Bouvard's obs.—(M. C., v. 14, p. 70) Huth, writing to Bode, under date 20th October, added to the foregoing that the comet was very bright in the centre, but without nucleus, and from 4' to 5' in diameter. He also stated that on the 1st November he perceived a tail of about 3° in length, and about one-third of the diameter of the comet in width. On the following day it was seen faintly visible near the body of the comet.—(A. J., 1809, p. 127, &c.) Bode perceived a small slender tail on the 1st November.—(A. J., 1809, p. 261,) Period of Encke's orbit = 12 1272 years.

1805 (2).—Second known appearance of the Gambart or Biela comet. D. by Pons on the 10th November, by Bouvard on the 16th, and by Huth on the 22nd. It was suspected that this comet might be the same as that of 1772 Gauss' first two orbits were parabolic, the third is elliptic The axis ma. = 2.82217, the period = 1731 days 17 hours.

He thought that this ellipse represented the obs. better than any parabola. Burckhardt and Bessel denied the identity; but, assuming it, Bessel found semi-axis $ma = 10.46544$. Schroeter gave 30 geographical miles for the diameter of the nucleus.—(Z. C., v. 3, p. 426) The period deduced from Bessel's orbit = 33 856 years. This comet was very small, had a nucleus tolerably apparent, but its nebulosity was so faint that the least illumination in the telescope effaced it. The 1805 (1) had much more light. (From a letter of Thulis', dated November 14, in M. C., v. 13, p. 85) Olbers remarked on Bessel's elements that the similarity between them and those of the comet of 1772 was striking, but that those of 1772 were only known very uncertainly. This comet was in perigee on the 8th December; its distance not exceeding 900,000 miles, and its light being seventy times that on the 10th November, when Pons discovered it.—(M. C., v. 13, p. 88) Olbers stated that on the 8th December the comet was well seen by the naked eye.—(M. C., v. 13, p. 90.) For Bessel's arguments against the identity with 1772, see M. C., v. 14, pp. 71-4. Huth said that on the 23rd November he saw no trace of a tail, possibly on account of the dampness of the atmosphere. He estimated the diameter of the nebulosity at from 6' to 7'.—(A. J., 1809, pp. 131-2.) Schroeter's obs. are given in A. J., 1809, p. 140. See also C. T., An. 14, and comet 1819 (4), in these notes. Gambart's orbit gives a period of 6.7370 years.

1806.—D. by Pons, on the 10th November. It disappeared about the end of December, being too far South. It was again seen on the 17th January, 1807, by Pons, and on the 23rd by Bessel. It must have passed the South ecliptic pole on the night of the 1st January.—(D., v. 3, p. 427) Miss Caroline Herschel caught this comet between flying clouds, on January 27th, after its Per passage. On February 1st, Dr. Herschel examined it with a ten feet reflector, low power. There was no visible nucleus, nor did the light, which is called the coma, increase suddenly towards the centre, but was of an irregular round form, and with this low power extended to about 5, 6, or 7 minutes in diameter. When he magnified 169 times it was considerably reduced in size, which plainly indicated that a farther increase of magnifying power would be of no service for discovering a nucleus. On account of cloudy weather he never had an opportunity of seeing the comet afterwards.—(P. T., 1807, p. 266.) Bessel wrote, under date 23rd December, that on the 7th its nucleus was faint, and its tail scarcely distinguishable. He stated that its light, on 10th November = 0.168, and on the 12th December = 1.257.—(M. C., v. 15, p. 86)

1807.—D. by Pons, on the 20th September.—(D., v. 3, p. 427.) (M. C., v. 16, pp. 562-3). Piazzi, and Seth Pease, in S. America. Since 1769 no comet of equal size and brilliancy had appeared. It was made

the subject of a memoir by Bessel. Period 1483 3 years by his second orbit; but, supposing improbable errors, the limits would be 1403 6 and 2157.4 years. The perturbations will cause great changes in the elements, principally affecting the duration of the revolution. The true diameter was 538 English miles according to Herschel. the volume $\frac{1}{1181}$ of the earth. According to Schroeter the nucleus was 997 geographical miles, the nebulosity from 26.0337 to 43.772 miles.—(D, v. 3, pp. 427-8) Bouvard stated that this comet was obs. in Paris on the 30th September, also that the nucleus shone as a star of 1st or 2nd mag, but with a fainter light—(M. C., v. 16, pp. 562-3) Olbers, under date the 7th November, said, "The most remarkable fact relative to this comet is its divided or double tail, I perceived it first on the 20th October. The comet has, as seen in the cometen-sucher, not one but two tails, which are distinctly separated from one another at about one and a half degree from the body. The Northern is the longest, very slender and pale, and quite straight. I can see it sometimes upwards of ten degrees in length. The Southern is much shorter, broader, and brighter, and considerably curved towards the South, about four and a half degrees long. I knew only one similar instance in the comet of 1744."—(M. C., v. 16, pp. 562-3.) Beck-Kalkoen wrote from Utrecht, that on the 10th December the comet's light was so faint that he could take no measures of distance.—(M. C., v. 17, p. 479.) Huth stated, that on the 29th September the comet was not so bright, but apparently as large as Jupiter, and the tail well seen by the naked eye, about 5° in length, and 30' wide. On the 1st October he estimated the *globe* to be as large as Mars, when nearest to us. He also remarked the convexity of the tail, and saw several stars through it—(A. J., 1811, pp. 116-118) Fritsch estimated the diameter of the nucleus at 6" from the 12th to the 15th October, but at fully 8" on the 25th and 26th. He also saw the division of the tail—(A. J., 1811, p. 150.) Bode fancied, on the 5th October, that the nucleus appeared oval.—(A. J., 1811, p. 164) He stated also, that Wisniewsky obs. this comet at St. Petersburg up to the end of March, 1808, or to the 27th.—(A. J., 1811, p. 169, and 1812, p. 95) Dr. Herschel gave 5', 6', or 7' as the apparent diameter of the coma on the 1st February, 1808.—(A. J., 1812, p. 231.) He also remarked a distinct and shining nucleus about $2\frac{1}{2}'$ diameter, and the surrounding nebulosity to be = 4' 45" in diameter. He estimated the divided tail at 3° 45' in length, on the 18th October, and calculated its real length to have been nine millions English miles. Its apparent length on the 20th November was 2° 30', and on the 6th December 23'. He computed also the true diameter of the comet to be = 538 English miles.—(A. J., 1813, p. 218) Cladni asserted that he had seen a species of ebullition in the tail of this comet,

and that he had seen it so often, for such a length of time, and so positively, that there was no room for doubt—(Z. C., v. 2, p. 309) Bessel's last parabolic orbit was the third which he computed. Flaugergues' obs are in Z. C., v. 2, p. 349, &c. The orbit in the Catalogue attributed to Damoiseau, on the authority of Olbers, was assigned to de Montfort by Delambre. In the P. T., 1808, pp. 145-159 will be found a most interesting paper, by Dr. Herschel, upon the physical peculiarities of this comet; the leading points in which are alone admissible to these Notes. He treated of the nucleus having had a disc apparently round, and everywhere of equal brightness. He estimated its diameter at first at 5", afterwards at less than that of Jupiter's third satellite. Of the head as apparently the size of Jupiter. Of the diameter of the coma as having been from 6' to 4' 45". Of the tail he distinctly said that it was not bifid. After which he proceeded to make obs. on the density of the coma and tail, and concluded with remarks upon the general nebulous appearance. See also *Coun. des Tens*, 1810-11.

1808 (1).—D. by Pons, in Camelopardalis, on the 25th March. It seems to have been obs. in France only five times, viz., on the 25th, 26th, 28th, 29th, and 31st March; and four times in Russia, by Wisniewsky, viz., on the 29th and 31st March, and on 1st and 2nd April.—(A. J., 1811, pp. 215-16, and 1812, p. 227) Encke's orbit agrees very well with the French obs., but gives large errors for those of Wisniewsky—(A. N., No. 97)

1808 (2).—D. by Pons, on 24th June.—(D, v. 3, p. 428), also in Camelopardalis.—(Z. C., v. 12, p. 511.) Pons, on his detection of it, said that it was the smallest of all those it had been his fortune to find; and this was his eleventh in eight years.—(M. C., v. 18, pp. 245-250.) Bessel's orbit was computed from the obs. of 26th and 30th June, and 3rd July. Pons discovered no less than four comets during this year: the first on the 6th February, between Serpens and Libra. It was very faint and small, and visible for only three days, the moonlight having absorbed it, and it was impossible to find it again. Another in Camelopardalis, of which but two obs were made, on the 3rd and 5th July, and the two comets given in the Catalogue.—(Z. C., v. 12, p. 509, &c.)

1810.—D. by Pons, on the 22nd August.—(D., v. 3, p. 428.) It was small, with a faint round nebulosity, and was visible until the 8th October. It was obs from the 29th August to the 21st September.—(M. C., v. 23, p. 302.)

1811 (1).—D. by Flaugergues, on the 25th March. The orbit by Burckhardt is only a first approximation. Flaugergues' ellipse gives a period of 1442 years, and an axis-major = 127.6442, Bessel's, a period of 3383 years, and an eccentricity of 0.9954056. Flaugergues thought

this comet to be the same as that of 1301. Bessel was of an opposite opinion. This comet was very remarkable, on account of its tail, and the duration of its apparition—(D., v. 3, p. 428.) We omit the two orbits by Burekhardt given by Delambre. This was the first comet seen by the compiler of these notes, and is one so generally known that it seems almost a work of supererogation to give any details of it, and, were it not that the omission would be an exception to the proposed plan of offering the present list of cometic orbits to the public, he would have been tempted to be silent. Pons saw it first on the 11th April, and got credit for some time of being the discoverer.—(M. C., v. 23, p. 422) Gauss stated that the form of the tail was very peculiar on the 7th September. It was bent off in two branches from the comet, but these two branches did not proceed from the comet itself, but were *hung* together at a slight distance from it, and separated from it by a dark interval, so that they enclosed the comet as a parabola does its focus—(M. C., v. 24, p. 305.) Its tail was broad, and above 5° in length.—(M. C., v. 24, p. 309.) For long memoirs on this phenomenon see M. C., v. 24, pp. 289 to 316, pp. 406 to 423; and pp. 507 to 522. On the 11th October the tail was above 13° long.—(M. C., v. 24, p. 417.) The diameter of the nebulosity was about 1' 20".—(M. C., v. 24, p. 421) Flaugergues said that this comet appeared to him to be the same as that which was seen in September, 1301; at least that the elements he had calculated of the present comet perfectly represented the obs. made by the Chinese astronomers in 1301, which are reported in the MSS. of Gaubil. According to this conjecture the period of the comet would be about 510 years—(M. C., v. 24, pp. 508–9) Bode gave an engraving of the appearance of the comet on the 11th September, and also of its apparent path.—(A. J., 1814.) Triesnecker said, that "it need not be stated, since it was a general complaint of astronomers, that this comet was difficult to obs., on account of the want of a defined nucleus, even as seen in good telescopes."—(A. J., 1815, p. 129.) The length of the tail on the 20th September, according to Bode, was 10°, and above.—(A. J., 1815, p. 167); and on the 4th December, only about 5°.—(A. J., 1815, p. 168.) Fritsch obs. the length of the tail to be about 3° on the 8th January, 1812.—(A. J., 1815, p. 261.) Dr. Herschel stated that during his obs. of the nucleus, so called, he remarked a round disc, which was somewhat brighter than the remaining part, and whose light and intensity varied. Having made use of the large telescope, he was assured that this solid nucleus was of a truly planetary nature, although surrounded by a cometic atmosphere. He added, that on the 16th October, the comet was about 114 millions of miles from the earth, and he estimated its diameter to be 428 miles.—(A. J., 1815, p. 265) In the P. T., 1812,

pp. 115-136, there is published by Dr. Herschel very important obs. of this comet, with remarks on the construction of its various parts. The same rule must be obs with regard to this paper as has been in former instances adopted, to bring the notice of it within the limits to which these notes have been restricted. He commenced with the planetary body in the head of the comet, and stated that within the spot, which perhaps some astronomers may call a nucleus, there was an extremely small bright point, entirely distinct from the surrounding glare; that, at the very first sight of it, he judged it to be much smaller than the little planetary disc in the head of the comet of the year 1807. After numerous obs. and comparisons with globules, he concluded the apparent diameter of this point to be equal $0'' 775$. He next proceeded to notice the eccentricity and colour of the planetary body, and stated that the situation of the bright point was not in the middle of the head, but was more or less eccentric at different times, and that the colour of the planetary disc was of a pale ruddy tint, like that of such equally small stars as are inclined to red. On the head of the comet, he stated that on the 18th September, it seemed to be about five or six minutes in diameter. Concerning the colour and eccentricity of the light of the head, he remarked regarding the former, that he examined it with all his different telescopes, and that in every one of them its light appeared to be greenish, or bluish-green; and with regard to the latter, that the disposition of the light of the head was accompanied with some remarkable circumstances, for that notwithstanding a general accumulation about the middle, there seemed to be a greater share of it towards the Sun than a portion in that situation of the circumference was entitled to had it been uniformly arranged. The first of two estimations of the apparent diameter of its head gave $3'$, and the second $3' 45''$. From a calculation, adopting the last measure, it appeared that the real diameter of the head was about 127,000 miles. The apparent diameter of the cometic atmosphere, on the 6th October, was $15'$, and the real diameter therefore more than 507,000 miles. He perceived also that the head of it was partly surrounded by a train of light, which was kept at some considerable distance by an interval of comparative darkness, and from its concentric figure he called this light an envelope, of which he found the shape, as far as it extended, to be apparently circular, but in its course it did not reach quite half way round the head of the comet. A little before it came so far, it divided itself into two streams, one passing by each side of the head. Its colour had a strong yellowish cast, forming a striking contrast with the greenish tint of the head. He concluded its apparent diameter to have been about $19'$, and, by computation, its real diameter to have exceeded 643,000 miles. Of the tail, he said first that it was very conspicuous,

and about nine or ten degrees in length, and that it increased on the 6th October to 25° . Having assumed the apparent length to be $23\frac{1}{2}^\circ$, which was his estimation on the 15th October, he inferred that its actual length must have been upwards of 100 millions of miles, having taken into consideration the oblique position in which he saw it. He added, that on the 9th and 10th September, the curvature of the tail was very considerable. His remarks on the general appearance of the tail are well worth perusal, as are also those on the disappearances of the transparent part of the atmosphere under the cover of the scattered light of the contracted envelope, on the uncommon appearances of the dissolution of the envelope, on the variations in the length of the streams, on the alterations in the angle of the direction of the envelope, on the shortening of the tail, and the increasing darkness between the streams that enclosed the tail, and of the real construction of the comet and its various parts. A Mr. Lee, writing from London, said that he doubted not that this comet was the same as that which appeared in 1301, to which Bode appended the following note.—“Pigré provisionally calculated the elements of this comet (1301) from very uncertain Chinese and English obs. long ago; therefore, and because these are very different from the orbit of our great comet of 1811, the identity is extremely doubtful. Both were, however, retrograde.”—(A. J., 1816, p. 163) Cladni obs. a kind of continual ebullition in the luminous matter of the great tail, which had some resemblance to the rise of the vapour of boiling water. This undulation passed from the head of the comet to the extremity of the tail in two or three seconds of time. What prodigious—what incredible velocity! It surpasses all human conception. It exceeds that of light, and probably that of electricity.—(Z. C., v. 2, p. 309) Gauss’ first orbit is the second in the Catalogue. P. P. of Conti’s elliptic orbit is given in M. C. for September 11th. The period resulting from Argelander’s orbit is 3065 years; from Conti’s, 3056 years, Le Maur’s, 2619 years, and Ferrer’s, 2417 years.

1811 (2)—D. by Pons, on the 16th November—(D., v. 3, p. 429.) Gauss wrote under date of 2nd January, 1812, to say that it was pretty bright, and would be observable some time longer.—(M. C., v. 25, p. 94.) Olbers remarked that it would be much easier to observe than the preceding, were the weather clearer—(M. C., v. 25, p. 99) Nicolai, having compared the parabolic elements of this comet with the obs., declared that its orbit could not be parabolic, and hence its elliptic elements.—(M. C., v. 27, p. 207) The period deduced from them is 875 4 years. Burckhardt wrote under date, 10th December, that the comet was small and faint, with an irregular nebulosity, but yet, that a nucleus could be discovered.—(A. J., 1815, p. 118.) Dr. Herschel stated that, on the first January, 1812, he viewed this comet with several of his

telescopes, and found it to have a considerable nucleus, surrounded with very faint cheveleure; that, on the 2nd, it had a large round nucleus within its faint nebulosity. Not seeing it very well defined, and of so large a diameter, he doubted whether it could be the body of the comet; but although it might be called very large, when supposed to be of a planetary construction, it was much too small for the condensed light of a head, its diameter, by estimation, not exceeding 5 or 6 seconds. By way of comparing the two comets together, he viewed them alternately. The first, within a nebulosity which, in the form of a brilliant head, was of great extent, had nothing resembling a nucleus; the light of this head was very gradually much brighter up to the very middle—its small planetary body being invisible. The second comet, on the contrary, although surrounded by a faint chevelure, seemed to be all nucleus; for the abrupt transition from the central light to that of the chevelure, would not admit of the idea of a gradual condensation of nebulosity, such as I saw in the head of the first comet, but plainly pointed out that the nucleus and its chevelure were two distinct objects. On the 8th and 18th this comet had a pretty well defined nucleus, with a very faint chevelure. He estimated the diameter of the nucleus, on the morning of the 21st January, at $5''2744$. On the 18th January he estimated the apparent length of the tail at $9'40''$, from which he deduced that its length must have been about 659,000 miles. Dr. Herschel concluded his paper with remarks on the construction of the comet, for which the reader must be referred to the paper itself—(P.T., 1812, pp. 229–237.)

1812.—D. by Pons, on the 20th July. The second orbit, by Niccollet, was deduced from the entire series of obs. made at the Imperial Observatory.—(D., v. 3, p. 429.) It was like an irregular nebula, without tail or *beard*; and only visible through a telescope. This was the 16th comet detected by the same observer, within ten years.—(M.C., v. 26, p. 270.) On the 14th September the diameter of nucleus (Kerns) was 5^s4 , and on the same day the length of tail = $2^\circ 17'$ —(M.C., v. 26, p. 410) On the same day Bode assigned to the tail a length of only 1° .—(A.J., 1815, p. 260.) For Flaugergues' obs see Z.C., v. 5, pp. 550–1.) For the first orbit in Catalogue, by Werner, M.C. gives, for P.P., September, 15 21006 For Niccollet's first orbit, M.C. gives, for L.P., $92^\circ 58' 30''$. The period from Encke's elements is 70.7 years.

1813 (1).—"D. by Pons, on the 4th February, being his 17th comet. It was very small, without tail, *hair or beard*, and appeared like a confused nebula."—Extract from a letter of de Zach, dated 8th February.—(M.C., v. 27, p. 194.) The second orbit of Werner, given in the Catalogue, is the third which he computed.

1813 (2).—D. by Pons, on the 28th March. He stated that, on the

2nd April it could be seen by a sharp-sighted person with the naked eye. This was his 18th comet.—(M. C., v. 27, p. 389) Detected by Harding on the 3rd April. It was small, and without tail, with a pretty bright nucleus in a round nebulosity, and invisible to the naked eye.—(M. C., v. 27, p. 386.) Gauss stated that this comet was visible to the naked eye on the 24th and 25th April.—(M. C., v. 28, p. 502) Olbers, that on the 25th April he could see no trace of tail.—(A. J., 1817, p. 98.)

1815.—D. by Olbers, on the 6th March. In his letter dated the 7th, he said that it was small, had an ill-defined nucleus, with a very pale transparent nebulosity, and could only be seen in the cometen-sucher. On the 6th April he thus wrote—"The small comet acquires light, and is now well shown in the cometen-sucher," and he added, that the nucleus continued very *washy* and ill-defined. On the evening of the 6th it showed a tail of from 8' to 10' in length.—(A. J., 1818, pp. 153-156) Bessel appears to have been the first computer of an elliptic orbit of it.—(A. J., 1818, p. 208) Olbers conceived that the period of 73 years must be very nearly correct.—(A. J., 1818, p. 218.) He also estimated the diameter of the nucleus in the beginning of May, to be 8", and the length of the tail at the same time to be not more than from 25' to 30'.—(A. J., 1818, p. 225.) The periods deduced from the elements of the respective computers are as follows—Gauss=77.338 years. Nicollet=72.991. Nicolai=74.788. Bessel=74.049 and 73.897; and Nicolai's 2nd=72.563. There is no known orbit of any previous comet that has any resemblance to the present.

1818 (1).—D. by Pons, in Cetus, on the 23rd February. De Zach determined four places from the Paris obs., but remarked that he did not think them so good as those of Pons. It appears that after many trials no parabola could be adduced which would not exhibit such great errors as to leave the orbit wholly doubtful. It was very faint.—(A. J., 1821, p. 166) Mr. Norman Pogson wrote last year (1850) as follows.—"No orbit has, I believe, yet been computed of the comet observed by Pons in 1818. indeed the four obs. taken were not very tempting ones. Mr. Hind has, however, deduced three places from them. From these places, as a first approximation, Mr. Pogson computed the elements given in the Catalogue." He then added—"As the original obs. were involved in a little mystery, from some supposed errors, Mr. Hind says that he will enter more fully on the subject, when the *corrected* elements are finished, which shall be as early as I can possibly find time for. The elements are almost identical with those of a comet which appeared in 1772, supposed to have been the comet of Biela. Probably it will prove to be an apparition of that body."—(Ast. Soc. Not., v. 10, p. 134.)

1818 (2).—D. by Pons, in Cygnus, on the 26th December, 1817.

Olbers saw it for the first time on the 4th March, 1818, and obtained six obs. to the 1st April, inclusive. In a letter dated the 3rd April, he stated that it was difficult to see, and still more so to observe; and that it resembled an undefined nebula, brighter in the centre—(A. J., 1821, p. 145.) Pons described it to have been a nebulous mass, without *beard*, tail, or nucleus, and the faintest of all the comets he had discovered.—(A. J., 1821, p. 158-9.)

1818 (3)—D by Pons, in Hydra, on the 28th November. He described it as small, round, and well defined. From three obs. made by him Carlini computed an orbit—(Z. C., v. 1, pp. 519-592) Pons afterwards observed in a letter, that these elements could not be expected to give its subsequent places, and he fancied that it was lost.—(Z. C., v. 1, p. 603), but Bessel, on the 22nd December, detected a comet in Cygnus, which he described as without nucleus or tail, invisible to the naked eye, but bright enough in the *cometen-sucher*.—(A. J., 1822, p. 171; Z. C., v. 2, p. 106) Carlini first suspected the identity of Bessel's comet with that of Pons, and calculated an orbit from the obs. of both astronomers—(Z. C., v. 2, pp. 108-9.) The result induced de Zach to pronounce their identity, and Bessel also computed elements from all the obs. which exactly represented the extremes of the positions he took, and the middle within half a minute.—(Z. C., v. 2, p. 187.) Bessel obs. it to the 27th January, 1819.—(Z. C., v. 2, p. 306) This proved to be a most troublesome stranger; for not only its Southern declination at first was apparently opposed to so great a Northern declination afterwards, and that within a month; but it was constantly called the comet of the 30th November, instead of the 28th, and in Carlini's elements the Node-Perihel. is invariably printed as Long Perihel. In Bessel's orbit the L. P. is printed in A. J., = $347^{\circ} 0' 24''$

1819 (1)—Fourth known appearance of Encke's comet—D. by Pons, in Pegasus, on the 26th November, 1818—(A. J., 1822, p. 135, and 192 to 194.) Described by him to have been very small, ill-defined, and of irregular nebulosity.—(Z. C., v. 1, p. 588.) Derfflinger stated, that in January, 1819, the nucleus was barely visible—(A. J., 1822, p. 157.) It was upon the present apparition of this comet that Encke made the remarkable discovery of its short period; identified it with three preceding appearances, and predicted its return. For interesting papers on the subject, see A. J., 1822, pp. 175 to 202. It was observed by Nicolai.—(Z. C., v. 1, p. 603) Harding's and Encke's obs. may be found in Z. C., v. 2, pp. 187-8. The last elliptic orbit in the Catalogue for this comet, and those for its returns in 1822, 1825, 1829, 1832, 1835, 1838, 1842, 1845, and 1848, are identical, excepting in so far as the perturbations, precession, and diminution of

obliquity cause them to differ. It is the most probable orbit deduced from obs. made at all the apparitions from 1819 to 1838, both inclusive.—(Olbers' *Abh.*, p. 221)

1819 (2).—D., accidentally, by Professor Tralles, of Berlin, on the 1st July.—(A. J., 1822, p. 214.) Bode said, on the 26th August it resembled a pale and rather oblong nebula, having a faint trace of tail towards the North.—(A. J., 1822, p. 216.) Professor Tralles, on his discovery, wrote thus to the Baron v. Lindenau:—"I sought in various ways during this night, (1st July,) so far as clouds permitted, the place of the comet that so unexpectedly appeared, and as accurately as possible. At $11^h 54^m 44^s$, M. T., I imagined its correct right ascension to be $100^\circ 35' 20''$. At $1^h 57^m 5^s$ after midnight its declination was $=40^\circ 8' 20''$, and right ascension $=100^\circ 40' 50''$, as obtained by an English theodolite."—(A. J., 1822, p. 252) For the obs. made at Greenwich, Genoa, Gotha, Milan, Mannheim, Padua, &c, &c., see Z. C, v 2, p 623. Olbers wrote under date, 27th July, as follows:—"The comet could not have been well seen in Europe before the 29th or 30th June. Whether or not it has been already discovered and observed early in spring by the Palermo astronomers, as the Paris accounts state, I leave to appear hereafter. Its light at that time must at least have been uncommonly faint. The comet is particularly distinguished for its planetary nucleus, but which seems to me not so defined as that of the comet of 1807. Of the tail, certainly splendid and long at the commencement of July, we have been able to see little, on account of the bright twilight and moonshine; and yet it extended to 7° or 8° , as seen in good cometen-suchers. It is highly remarkable that the earth was, on the 26th June, exactly in the direction of this tail. Sun, comet, and earth, were so nearly in a straight line on the morning of the 26th, that the comet must have been visible on the disc of the Sun, and a transit of the comet over the Sun the result. From a computation instituted thereupon, I find that the entrance of the nucleus upon the S. edge of the Sun took place on the 25th July, at $7^h 39^m$, M. T., Berlin. The relative motion of the comet towards the Sun was almost exactly from S. to N. At $19^h 30^m$ the comet was within $1' 27''$ W. of the centre, being then at the nearest point to it; and at $21^h 18^m$ it emerged from the N. edge. How far the tail of the comet extended cannot indeed be determined with certainty, but it is highly probable that some portion of its matter reached our atmosphere, from which, however, I expect no remarkable effect of any kind."—(A. J., 1822, pp. 178-9.) He added in a note that he had received a letter from General von Lindener, in which he stated that he had observed the Sun at 5, 6, and 7 o'clock on the morning of the 26th June, and that the disc was free from maculæ. A reference to the obs. made at Palermo will

show that the Paris accounts, before alluded to, were incorrect; the obs. at Palermo having commenced on the 3rd July, whereas Tralles discovered the comet on the 1st—(See A. J., 1823, p. 122.) Olbers wrote again, under date of 8th April, 1820.—“I saw the comet of July, 1819, for the last time on the 20th October, and obs. it lastly on the 12th. It disappeared also on account of its faintness, not because it was too small to see, for in the last very difficult obs. it was about 2' in diameter, but with so little light, that its entrance into, and exit from, the circular micrometer, could only be determined with some degree of certainty . . . Now for something more on the remarkable transit of the comet over the Sun.—There is no doubt that the comet truly passed over the Sun, near its centre, from S. to N., between 5 and 9, A.M., Bremer time, of 26th June. All the elements calculated give this transit, and only differ some minutes of time as to ingress and egress; and some seconds as to the shortest distance, according to the elements selected By Dirksen's amended elements, and by true time of Milan, the ingress was on the 25th June, at $17^h 30^m 34^s$, and egress at $21^h 5^m 37^s$. At $19^h 18^m 6^s$ the comet was within $2' 8''$ of the solar centre, being its nearest approach: this statement being referable to the earth's centre. On account of aberration all the phases appeared $5^m 51^s$, and on account of parallax $0^m 50^s$ later in the German Observatories. Whether the comet could have been seen on the solar disc, or whether, as I assumed in the Jahrbuch for 1822, from the obs. which were then known to me, its nucleus was so translucent that it produced no perceptible obscurity on the disc on which it was projected, does not appear to me fully decided True it is, that the worthy General von Lindener, and also an Austrian observer, examined the Sun during the time of this transit, and saw no speck whatever. I thence drew the conclusion that the comet was altogether invisible upon the Sun. But it is now averred that at that time the Sun was not free from specks, and as these two observers certainly overlooked the existing specks on the Sun, so might they have also overlooked the comet, at all events more difficult to detect, when the former were just visible to a sharper or more attentive eye” That at the specified time maculæ were truly on the Sun, two unexceptionable witnesses attest. Professor Schumacher, of Copenhagen, writes to me under date, 18th February, 1820.—“I have determined the collimation of my seven inch sextant by Troughton, which I had with me during my stay at Altona, on June 10th, 16th, 18th, 19th, 20th, and 25th at about 20^h ; and therefore the last time, when, according to the calculations, the comet was upon the disc of the Sun; and I know decidedly that I did not see it a single time without spots. I can answer for the accuracy of my obs.; since in Lauenberg, before the comet appeared, mention was made of solar spots. The fact, which was then fresh in my recollection, was stated

that I had not throughout the summer seen the Sun without spots. As to date and time of obs. my journal testifies that I had increased the magnifying power of my sextant's telescope about 10 times on these unimportant obs. There is therefore no probability that one of the dark spots was the comet." So far M. Schumacher. What follows is from a letter from Professor Brandes, of Breslaw—"I should have obs. some solar spots for a longer time last summer, but that the obs. were not so perfect as I wished, and I shall therefore rather try a new series than draw upon these imperfect conclusions. Still I must send you something thereout. On the 26th June, the day when, according to your calculation, the comet should have appeared on the Sun, I obs. it a little before noon, later certainly than the time the comet should have left the disc, but my obs. is not without value as a correction of that by General von Lindener, inasmuch as I did not see the Sun entirely without spots, for one was very easily recognisable, situated on this day near the edge of exit in its proper place. General von Lindener must either have had a less favourable sky or an inferior telescope, and therefore did not see this considerable spot, although it was not so clear while it was near the edge as it had appeared some days before. Thus the comet might have also escaped him even had he seen this spot. The von Lindener obs. also only shows, what was otherwise to be conjectured, that the comet was not so dark as sometimes a planet appears."—(A. J., 1823, pp. 135-6) The paper from which the preceding extracts have been taken is much longer, but this note has already extended too far. For numerous obs. made at Seeburg and Padua, see Z. C., v. 3, pp. 202-5. In A. J., the L.N. of Dirksen's orbit is given $= 273^{\circ} 42' 9''$, and of Sniadecki's $= 273^{\circ} 3' 33''$.

1819 (3).—D. by Pons, on the 12th June. He announced its appearance to be small, without tail or visible nucleus, its centre of sufficiently marked *whiteness*, bearing a little illumination, and not to be suspected with the naked eye, and apparently descending towards the equator, leaving the Sun—(A. J., 1822, p. 207,) (Z. C., v. 2, p. 519.) Encke writing under date the 22nd August, 1820, added in a P.S.,—"Let me be permitted here to add the probably approximate orbit of another remarkable comet of the past year of which v. Lindenau gave an account in the last Jahrbuch" He then appended the elliptic elements and proceeded—"A very short period is also applicable to this comet, but the small number of obs. does not permit the accurate determination within what limits it must fall."—(A. J., 1823, pp. 221-3) For the Marseilles obs, see Z. C., v. 2, p. 613, and for those made at Milan, Z. C., v. 3, p. 196. The first elliptic orbit by Encke gives a period of 857 days.—(Z. C., v. 3, p. 198.) The second, by the same astronomer, assigns to it a revolution of 2051.93 days.—(Z. C., v. 3, p. 293.)

1819 (4).—D. by Pons, on the night 4th 5th December. "Scarcely

had the celebrated Pons set his foot in the Duchy of Lucca, whither he had been called by his Sovereign to direct the new observatory (Marlia,) before he discovered a new comet in the left wing of Virgo. It was very faint, invisible to the naked eye, without tail, beard, or nucleus. In the Finder it presented itself as a round nebulosity, ill-defined, and about 5' or 6' in diameter. Pons saw it for the last time on the 30th December. It was very faint. This comet was obs. at Bologna, Vienna, and Augsburgh."—(Z. C., v. 3, p. 193.) De Zach remarked, that it was so difficult to obs that it was in fact very little and very ill obs., either on account of the unfavourable season in which it appeared, or from its extreme faintness. Encke, who computed an orbit of this comet, could not succeed in making the obs. of Marseilles, Bologna, and Milan, agree. He could not represent the last nearer than from 5' to 7'. As the obs. of this comet cannot be referred to a parabolic orbit, Encke suspected that they might be by an hyperbolic. The errors of from 5' to 7' which the parabolic elements give are perhaps as much within the limits of the precision of the obs. themselves, as the limits of the conic sections. The comet, without tail or nucleus, was 5' or 6' in diameter. It was so pale and faint that many persons for whom Pons placed it in the field of the telescope, could not see it. It was nevertheless discovered in two places at the same time. It was obs. at Milan, where exist the only true obs. which assure us, if not of an orbit, at least of the fact that the object was seen, which many people have doubted—(Z. C., v. 4, pp. 518-20) Encke said that this comet was discovered nearly at the same time by Pons, at Marlia, and Blanpain, at Marseilles—(A. J., 1824, p. 217) The period deduced from his orbit given in Catalogue=4.8096 years. Biala remarked that the obs. of this comet permitted of a good representation by an ellipse of 2535 days and that this was the case with the comet of 31st December, 1805, (1805 (2), and that of 27th February, (query January,) 1785. "As the times of P.P. of the two last comets accord well enough with the specified periods, so I hold them to be identical, notwithstanding the great difference in the various elements given; and I proclaim now the return of the comet to the P at the end of October, 1826. If one goes back with a period of six years eleven months, one hits upon the comet of April 19th, 1771, February (query January,) 13th, 1792, and of December 31st, 1798."—(A. J., 1827, pp. 206-7.) Clausen wrote to Olbers as follows, under date of 11th December, 1832:—"I am fortunate enough to be able to announce to you a new discovery that I have made in the theory of comets, viz:—that the two comets of 1743 (1), and 1819 (4), are very probably identical, and certainly with a period of 6.727 years before 1758, and of 5.60 years to 1817, it will also in the autumn of 1836 again return to its perihelion."—(A. N., No. 237.)

The letter is quite too long to transcribe for these notes, but is very interesting. Suffice it to say, that Olbers was disposed to agree with Clausen. M.M. Laugier and Victor Mauvais, in allusion to the preceding opinion of Clausen, after introducing this comet into a series with those of 1585, 1678, 1770 (1), and 1844 (1), observed, that notwithstanding the singular concordance of this series, it seemed to them that the L. P. of the comets of 1743 (1), and 1819 (4), were too different to permit of their being considered as identical with the others. —(C. R., v. 19, p. 558) For the obs. made at Milan and Bologna, see Z. C., v. 3, pp. 297–8, and for various remarks on the first three comets of this year see same vol., p. 193, &c. See also the note on 1844 (1.)

1821 —D. by Pons, on the 21st January. It appeared like a white spot, without marked nucleus, and with a small point, (or tongue,) which seemed to indicate the origin of a tail. It was not visible to the naked eye, but was well seen in the Finder. On the following day he saw it again. It had not sensibly moved, so far as he could judge from his diagrams, but its brilliancy had increased, as also its tail, which had stretched out to about 2° . Pons compared it to a jet d'eau!! On the 25th January, its brilliancy and tail still continued to increase, and some persons fancied that they could see it with the naked eye, nevertheless, it was still difficult to observe on account of its vague and diffuse light that showed no defined point. This comet was also discovered by M. Nicolle nearly at the same time at the Royal Observatory, at Paris. It was also detected by Blanpain four days later at Marseilles.—(Z. C., v. 4, pp. 413–4.) Blanpain stated that on the 25th January its nucleus was very apparent, but badly defined, and similar to a star of 7th, 8th mag, that the nucleus was surrounded by a faint coma of about 4' in diameter, and that it was characterized by a tail equally feeble in light, of a pretty regular form, about $1^{\circ} 30'$ in length, and rather wider at its extremity than at its root.—(Z. C., v. 4, p. 415) Santini said that the splendour of the comet was so increased that it could be seen (19th February) with the naked eye; and that he estimated the length of tail at $2^{\circ} 30'$.—(Z. C., v. 4, p. 510.) Olbers remarked a singular physical fact connected with this comet, viz.:—that, as it approached the Sun and earth, its nebulosity became more vague and ill-defined.—(Z. C., v. 4, p. 619) Lalande's prize was divided between Pons and Nicolle.—(Z. C., v. 4, p. 628.) Olbers detected it on the 30th January, when its tail appeared to him to be from $45'$ to 1° in length. In the nebulosity of the head he obs. at times a small faint nucleus —(A. J., 1824, p. 99) For Valz's remarks, see Z. C., v. 10, p. 274. This comet was obs. in several places in the Southern hemisphere. For Captain Basil Hall's obs. at Valparaiso, and Dr. Brinkley's elements of the same, see P. T., 1822, pp.

46-63. A plate, showing the appearance of the comet, is annexed to the papers.

1822 (1)—D. by Gambart, on the 12th May “We announced, in a fly-sheet attached to our last number, the new comet that Pons discovered at Marlia, on the 14th May. We have since learned that Gambart at Marseilles, and Biela, at Prague, discovered it, the one on the 12th, and the other on the 17th May, at about the same hour in the evening”—(Z. C., v. 6, p. 381.) Encke's second orbit, given in the Catalogue, agrees perfectly with those computed by Carlini and Gambart.—(Z. C., v. 7, p. 183.) In writing upon this comet, Encke said that an important ellipticity could not be admitted, therefore he could not assent to the conjecture of Biela on the identity of this comet with those of 1797, 1780, and 1590, but still more on account of the variance of most of the elements with those of the former. The comet must have experienced the strongest perturbations, which again the equality of the periods would have wholly destroyed.—(A. J., 1825, p. 156.) Hallaschka stated, that on the 18th May, the nucleus of this comet was very luminous, and that on the 21st, he saw the stranger, with the naked eye, like a faint whitish nebula, the centre of which appeared to be somewhat brighter.—(A. J., 1825, p. 158.) See A. J., 1826.

1822 (2)—Fifth known appearance of Encke's comet. D. by Rümker, on the 2nd June, at Paramatta—(Z. C., v. 8, p. 108) De Zach, in his notes on this discovery, gives well-merited praise to Rümker for his assiduity in the research after this body. After giving the various differences between the obs and elements, de Zach said: “M Encke is occupied, at this moment, with the long and difficult computation of all the perturbations that this heavenly body has experienced, and the very important results of which we hope soon to communicate to our readers.” M. Encke will discuss, upon this occasion, whether or not the resistance of the ether could have influenced its revolution, and whether or not there can be explained, as arising from this cause, the remarkable diminution of its period.”—(Z. C., v. 8, pp. 279-80.) Subsequently de Zach quoted from a letter from Encke as follows: “The obs. of Rümker have confirmed the justice of our calculations, and have established the problematical fact, that the period of the revolution of this heavenly body is diminished at each return. This sufficed to induce us to undertake the trial of some hypothesis, through which might be removed, at least partially, one of the principal difficulties which opposes our determination of the true course of comets.” After a detail of the mode which he adopted, he continued:—“It is therefore clear, that either the attractions act quite differently on this body from what they do on the planets, or that there exists, inde-

pendently of these perturbations, some other unknown cause, that to a considerable degree affects its course. . . . The most natural (hypothesis) that offers itself is that of the existence of a medium or an ether in space, the resistance of which, acting as a tangential force upon the motion of the comet, increases the power of the Sun, and abridges the period of revolution of the moving body. . . . Notwithstanding all that (he had previously stated) one cannot avoid offering some hypothesis on the nature of this resisting medium, without which we cannot determine the relation of the variation of the eccentricity to that of the period of revolution, or of the mean motion. I have then supposed, with Newton, that the ether, or resisting medium, is disseminated throughout space, and coherent with the Sun, and that its density diminishes in the inverse ratio of the squares of its distance from the Sun; and that the force of its resistance is always proportional to the square of the actual linear velocity of the comet."—(Z C, v. 9, pp. 189-194.) This entire paper is well worthy of perusal, but is quite too long for transcription into these notes. In offering prospective elements for this return of the comet, Encke acknowledged that the result of his computations did not altogether answer his expectations. After quoting the four preceding periods at which it had been obs., he proceeded:—"If it had been possible to find a set of elements which would have represented with sufficient precision all the positions of the heavenly body during the 33 years that it had been obs., paying attention to all the perturbations to which it has been exposed, and that one could have calculated them up to the present time, one should have been able, doubtless, to have declared with certainty and precision the place of its re-appearance. But after computing the perturbations of all the planets, so far as they could exercise a sensible influence upon the path of this comet, it has been found that all the elements of its orbit had sufficient accuracy for this purpose, excepting that of the mean motion, and of the P P. depending upon it, of which the rather doubtful determination suffices to produce an uncertainty of some degrees as to the place of the comet in perigee." He then showed a progressive diminution of the periods of revolution, having, apparently, a regular progression.—(Z. C., v 4, p 262-3.) De Zach appended a note to Encke's paper, from which it appears that *he* first suggested the appellation of "Encke's Comet," Encke himself having always called it after Pons. Many remarks on this apparition of Encke's comet are to be found in A. J., 1826, but there is little therein beyond what has been extracted already from the de Zach Corr. Encke's first orbit gives a period of 3.3176 years. For corrected places, from obs. by M. Rümker, see P. T., 1829, pp. 54-5. For Lieut. W. Robinson's obs., at Rio de Janeiro, see P. T., 1831, pp. 7, 8.

1822 (3).—D. by Pons, on the 31st May, at 2 A.M., being 17 days after his detection of 1822 (1) In announcing his discovery, he stated that it had neither tail nor nucleus, and appeared to be simply a nebula, more condensed near the centre. He thought it to be so apparent that it would be visible to the naked eye in the absence of moonlight—(Z. C., v. 6, p. 385) De Zach said that this comet was discovered under such disadvantageous circumstances, that it was observed in very few places. The position in which it was found was so far to the South, and it advanced so rapidly in a Southerly direction, that in less than 15 days it was lost below the horizon, before the news of it could reach all observers. Up to the present time, (date omitted,) Caturegli, at Bologna, and Gambart, at Marseilles, have alone obs. it the obs. at Bologna are not very accurate on account of the difficulty arising from its very faint light—(Z. C., v. 6, p. 481.) The only obs. of this comet seem to be one at Marlia, two at Marseilles, and four at Bologna. From these Heiligenstein computed both his sets of elements, and the differences between the obs. and places obtained from the elements are too considerable to permit the orbits to be esteemed higher than as approximations. See A. N., No. 96 For Captain W. Robertson's, and Mr. Drinkwater's obs., see P. T., 1831, pp. 1-7.

1822 (4).—D. by Pons, on the 13th July. He described it as very small, invisible to the naked eye, and a very white but not large nebula. He added, that he had remarked, at intervals, a slight scintillation in its centre, as if there were two small stars in it. This was the third comet D. by Pons within two months—(Z. C., v. 6, p. 483) It passed very near the pole of the ecliptic. From the 21st August it began to show a tail, opposed to the sun, of about $1\frac{1}{2}^{\circ}$ in length, and was well seen by the naked eye.—(Z. C., v. 7, p. 95.) "Our readers have already seen by our preceding number, that the motion of this comet was decidedly elliptical, and its orbit but little eccentric. The obs. of this remarkable heavenly body have been since multiplied, computation obtained a better hold, and Encke, as one might expect, has not permitted this opportunity of exerting his power to escape him. Hence, he reduced the elements of an elliptic orbit, approaching so many of the obs. that they only need some small corrections. The result gives a period of 194.072 Julian years."—(Z. C., v. 7, pp. 185-187-8.) "In our first number of the 7th vol. we published the elements of an elliptic orbit of this comet, computed by Mossotti at Milan, of which the semi-axis major was 1.9765, and the period 1139 days. In the following number we gave the ellipse calculated by Encke, of which the semi-axis major=33.520, the period being 194 years. What a prodigious difference between the elements, with so small differences from the obs.!! Mossotti deduces an orbit from 50 days

obs. and an arc of 77° , whose elements accord within some minutes with the obs., and which is, nevertheless, *toto cælo* distant from the true one. What then becomes of the elements of orbits calculated on a few days obs. and on small arcs? Is it from such elements that we are to recognise the identity of these heavenly bodies? Their returns are announced and expected!! and people are quite astonished that they do not arrive at the time named!!"—(Z C, v. 7, p. 293.) De Zach would have been rather more surprised at finding that the second orbit in our Catalogue, computed by Encke, gave a period of 1554 years, that of Rumker, 1817 years, and the fourth of Encke, 5449 years!!! Rumker obs. it at Paramatta—(Z C, v. 9, p. 131) The last obs. made in Europe was on the 22nd October, but the comet was followed by Rumker to the 11th November. He gave it the name of Rhea Silvia—(Z C, v. 9, pp. 135-6) There seem to be no remarks on this comet in the A. J. Encke's third orbit was deduced from the second and third orbits given in the present Catalogue. See also A. N., Nos. 21, 24, 37, and 55. For M Rumker's obs., see P. T., 1829, pp 55-7.

1823.—D. doubtful. Detected by Pons, on the 29th December, when he seized it by the tail! He thus described his first view of it in a letter dated the 30th December—"Yesterday morning, at about 4^h 50^m A.M., I saw an appearance, over the little hill which rises to the N.W. of us, resembling a slight chimney smoke, and some minutes later, a beautiful and large comet, with a fine nucleus and tail, displayed itself. It is pretty visible to the naked eye, and its tail may be from 3° to 4° in length" De Zach said that this comet having appeared on a sudden, like Minerva, armed at all points, showed itself to all the world with ostentation, and thus all the world discovered it. Santini found it on the 3rd January, 1824. It seems also, from a letter of the Baron de Lindenau, that it was seen on the 30th December, 1823, by Schutz, near Bonn—(Z. C, v. 9, pp. 595-8) Horner wrote to De Zach, to say that it was seen as early as the 1st December, in the Canton of Appenzel, in Switzerland. A chasseur informed M Horner, on the 5th December, that he had seen it in company with several others, and that it appeared in the N.W.—(Z. C, v. 10, p. 83) Biela saw it, for the first time, on the 30th December, and Nell de Breauté wrote from Dieppe, stating that he discovered it on the 28th December. De Zach gives him the credit of having been the first—(Z. C, v. 10, p 186.) "I have obs. but little with the circular micrometer, the comet of this year, which is so remarkable on account of its very anomalous tail turned towards the Sun, if, indeed, one dare so call this emanation of light, as it was so soon to be seen on the meridian. . . . I remarked first, on the 23rd January, this anomalous tail, and certainly

it was of almost equal brilliancy with that opposed to the Sun."—(Extract from a letter by Dr Westphal.) He added that he estimated the length of this anomalous emanation at $4^{\circ} 15'$, while that of the ordinary tail was $3^{\circ} 30'$. On the 24th January he considered the former to have been 7° long, but scarcely half as broad as the latter, which was $4^{\circ} 30'$. He stated also, that on the 27th the two tails stretched in right lines from the comet, but formed with the head a very obtuse angle of about 170° more or less. So bright was the night of the 28th January, that he was unable to perceive the least trace of the anomalous tail, but in return for this, on the night of the 31st, it shone forth again, at the first glance with the cometen-sucher, in a perfectly cloudless sky, although paler and smaller, but somewhat longer than the tail in opposition to the Sun. The two at that time formed a marked angle with the head, which he found to be $138\frac{1}{2}^{\circ}$. He saw no more subsequently of this wonderful tail.—(A J, 1827, pp. 132-4) For some further remarks by Olbers, see A J, 1827, p. 184. Diagrams of the appearances of this comet are appended to the vol. See also A. N, Nos. 48, 51, and 55.

1824 (1).—D by Rumker, at Stargard, on the 15th July, and not seen in Europe —(A N, No. 78.) There is no description of it in the Markree Observatory. See M. Rumker's obs. in P. T., 1829, pp. 58-59

1824 (2).—D. by Scherthauer, at Chemnitz, on the 23rd July, according to Encke's letter of the 24th August —(Z. C, v 11, p 193); and the same astronomer failed to remark any trace of eccentricity in the orbit, which should, however, have exhibited itself if ever so slight —(Z. C., v 11, p 296) See also A. J, 1827, p. 200. It was detected by Pons on the 24th July. It was very small, quite invisible to the naked eye, and without tail. At intervals a nucleus was perceptible, not in the centre of the nebulosity —(Z C, v 10, p. 615) Gambart found it on the 27th July, and Harding on the 2nd August. Pons, in a letter dated 21st August, said that the comet appeared to increase for some days, that a faint nucleus was forming, that could be seen at intervals by a very feeble scintillation; that it seemed somewhat more extended on the night of the 20th, in the direction opposed to the Sun, which indicated the commencement of a train, but that it was too feeble to admit of positive assurance —(Z C, v 11, pp. 97-98.) Capocci, on the 28th August, communicated his conjecture that this comet was the same as that of 1802 —(Z C, v. 11, p. 191) Littrow, in a letter to de Zach, expressed his surprise that in no number of the Z. C. was there any remark to be found on the singular scintillation exhibited by this comet, and which he had obs. up to the 5th October —(Z C., v. 11, p. 383.) This was a mistake of which the readers of this note are already aware. Pons wrote again on the 16th November, stating that he had

obs. the comet up to the 15th November, and that he suspected that there still existed, on the 4th November, a slight scintillation in its centre—(Z. C, v 11, pp. 489-90) He continued to observe it further until the 29th November—(Same vol, p. 492) Again Pons wrote on the 21st December, transmitting configurations of the comet and stars in Camelopardalis for the nights of 10th to 13th December, both inclusive. On the 18th December he saw it well enough to observe it with a transit instrument. On the 19th he could perceive no trace of it, and nevertheless he saw it again on the 24th, which, with good reason, he thought very surprising. He attributed the cause to the brilliancy of a star which was very near the comet, but de Zach observed that even without this cause, many astronomers, as Carlini, Littrow, and Pons himself, remarked very singular anomalies in the light of this body Capocci wrote to him as follows, from Naples.—“The very just remark of Carlini, on the extraordinary light of this comet, has not only been confirmed by my obs, but it appears to me that it has acquired some importance, of which you will judge yourself after the remarks I am about to make. First, as Carlini has said, the light of the comet increased in the first half of August. In the second half, it did not increase, I am sure that it did not diminish. In the beginning of September it increased so as to be always visible, even in presence of the full moon. About the middle of this month, its light appeared to me to arrive at its maximum. At the commencement of the month of October it had diminished considerably, and towards the end of this month it had become very faint. At the beginning of November, the extreme faintness of its light seemed to me surprising, and from this period it continued to diminish rapidly. To explain these facts, the generally-received hypothesis, that a heavenly body is illuminated by the Sun in the inverse ratio of the squares of its distances from the Sun and the earth will not suffice, for, if so, the comet should have been always losing its light, and we have seen that it increased up to the 20th September, and from this period it diminished much more rapidly than it should have done on the hypothesis in question. But all these appearances are explained by substituting the cube for the square of the distance from the Sun. then the agreement between the photometric phenomena and the law which establishes them is perfect”—(Z C, v. 11, pp 584-590.) Capocci followed the comet until the 25th December.—(Z C, v. 12, p. 119) Encke wrote to de Zach, to say that, having compared the last Neapolitan obs. with the elements, he was satisfied that the suspicion he had entertained that the orbit was *not* parabolic, was without foundation—(Z C, v. 12, p. 503.) In these days, the fact of a great inclination of any comet would probably deter any one from conjecturing an elliptic orbit. The hyper-

bolie orbit, by Encke, has been omitted from the present Catalogue, in consequence of what has been stated. Hansen's elements were founded on an obs. by Olbers, of the 6th August, and two obs. by Schumacher, of the 24th August and 24th September—(A N., No 66.) Argelander's orbit on the Paris obs. of 4th August, a Königsberg obs. of 29th August, and one by himself on the 23rd September—(A N., No 67)

1825 (1)—D. by Gambart, on the 19th May, in Cassiopeia. Pons did not see it until the 1st June, on account of overcast weather. It was described as small, round, with a very white nebulosity, and dense in the centre, without tail or nucleus. A slight *beard* was suspected on the side opposed to the Sun—(Z. C., v. 12, pp. 513-4) Pons, in a letter dated 11th June, signified his general agreement with the preceding remarks, but added that there appeared to be two white *ledges* in the centre. He also fancied that on the 7th June he saw a faint and slender tail, about $1^{\circ} 30'$ in length. On the 8th he could scarcely confirm his supposition. On the 9th he still suspected this little tail, and thought the nebulosity somewhat extended.—(Z. C., v. 12, pp. 610-1.) Carlini observed that the resemblance of this comet to that of 1790 (3), first noticed by Gambart, had been sufficiently confirmed to merit the attention of astronomers.—(Z. C., v. 13, p. 85) Pons wrote on the 16th July, to say that he had seen the comet on the 14th, although many astronomers had lost sight of it for a month—(Z. C., v. 13, p. 87.) Olbers considered that this comet's path diverged apparently so little from a parabola, that it could not be identified with 1790 (3)—(A J., 1828, p. 152) Nicolai agreed with Olbers—(A J., 1828, p. 195.) That the resemblance between the elements of these two comets is strong, cannot be denied, but, as has been before remarked, the great inclination of both is opposed to either being supposed to be what is commonly called periodic. M. Rumker discovered this comet, independently, on the 9th July, at Stargard. His obs. and elements may be found in P. T., 1829, p. 60.

1825 (2)—D. by Pons, on the 9th August, in Auriga, while on a search for Encke's comet.—(Z. C., v. 13, p. 183.) Harding detected it on the 23rd. Pons said that it was very small.—(Z. C., v. 13, p. 284.) We have no further account of it in the Markree Observatory

1825 (3).—Sixth known appearance of Encke's comet. D. by Valz, on the 13th July.—(Z. C., v. 13, p. 191.) Detected by Plana, on the 10th, and by Pons, on the 14th August—(Z. C., v. 13, p. 183.) Cacciatori described its appearance to have been round, with a faint nebulosity, of about equal density, and about $1^{\circ} 30'$ in diameter.—(Z. C., v. 13, p. 383) The best series of obs. of this comet, on its present return, appear to have been made by Capocci, at Naples. See note on 1819 (1). See also Z. C., v. 13, p. 88.

1825 (4).—D. by Pons, on the 15th July, in Taurus —(Z. C., v 13, p 38) Announced in this paper, by de Zach, as Encke's comet, a mistake which he subsequently rectified in v. 13, p. 182, and one very natural, the situation of this comet in the heavens having been very near to the place assigned by Encke himself to the anxiously-sought-for comet. Pons, of course, at first fell into the same error. He stated that it was very faint, the nebulosity of but little magnitude, not round, inasmuch as some elongation was suspected, rather denser in the centre, but without visible nucleus —(Z. C., v 13, p. 89) It would appear that, so early as the 19th July, Pons had some misgivings as to this comet being that called after Encke —(Z. C., v 13, p 140, note) It was detected by Biela, at Prague, on the 19th July —(Z. C., v 13, p. 279) Capocci wrote on the 29th August, to say that it appeared to have sensibly increased, being surrounded by an extensive nebulosity, and with a broad tail above 1° in length. Its light was, nevertheless, faint. On the 10th September the same astronomer stated that the comet had already become visible to the naked eye, and he predicted that in October, and particularly about the middle of that month, it would acquire a remarkable beauty and extent, which would strike and engage the public —(Z. C., v. 13, p. 282-3) De Zach, writing on some day in October, 1825, said that the comet continued visible, not only to astronomers, but amateurs, in fact, that it had become an object of curiosity and conjecture to the lowest class of people —(Z. C., v. 13, p. 386) Considerable changes appear to have taken place in the aspect of the tail —(Z. C. v. 13, p 391.) It was long and slender, shaped like a peacock's tail, divided into two branches, one being short, and the other 8° in length. Again it was trifid, and at another time separated into many divisions. Santini, on the 5th November, wrote, among other things, to say, that on the 6th October, the nucleus did not appear to be round, but as if formed of three splendid points; and, that on this night, the tail was 7° long, and on the 10th October about 9° .—(Z. C., v. 13, p 591.) The re-appearance of this comet in 1826, was predicted by de Zach —(Z. C., v. 13, p. 486.) The Neapolitan obs. for the year 1825 concluded on the 18th October —(Z. C., v 14, p. 94) Pons, Valz, and Cacciatore recovered their view of this comet in 1826, at nearly the same time On the morning of the 2nd April Pons found it, and lamentable were his cries at the miserable plight of its condition. He described it as totally destroyed—without tail, beard, coma, or nucleus—a mere spectre¹¹—(Z. C., v 14, pp. 402-3) Pons attended to it from the 2nd to the 18th of April, notwithstanding his disgust at its *undressed figure* —(Z. C., v. 14, p 492) Inghirami obs. it until the 16th May, (Z. C. v. 14, p 500) and continued to follow it until the 12th June, inclusive.—(Z. C., v. 14, p. 590.) Pons did not bid it farewell

until after 8th July.—(Z. C., v. 15, p. 79.) Harding stated that on the 10th August, 1825, the tail was about $1^{\circ} 30'$ long, and perceptibly curved, so that the convexity was towards the North—(A. J., 1828, p. 192) Mr. Reeves, of Canton, gave an account of this comet, which was seen at sea on the 3rd, 4th, 5th, 10th, and 30th October. When it was first obs it was in a line between η Eridani and π Ceti, at about one-third of the distance between the two stars from the former On the 30th it was so near α Gruis, that that star appeared to form the nucleus of the comet—(R. A. S. Notices, v. 1, p. 27) For obs. by Domkapitular and Stark, in May, 1826, see A. J., 1829, p. 188. Of the elliptic orbits given in the Catalogue, Rumker's produces a period of 152 years. Hansen's first = 382 years, and his second = 4386¹¹ years. De Zach gives another ellipse, by Hansen, not included in the present Catalogue, which yields a period of 556 years. See v. 14, p. 175. For M. Rumker's obs, and elliptic and parabolic elements, see P. T., 1829, pp. 60-65

1826 (1).—Third known appearance of the Gambart or Biela comet. D. by Biela, on the 27th February—(Z. C., v. 14, p. 394) It was detected by Gambart on the 9th March, in Cetus, and described as a feeble nebulosity, without tail or nucleus—(Z. C., v. 14, p. 299) Gambart, in a letter dated 22nd March, noticed a similarity between the orbit he deduced from his earlier obs, and those of the comets 1772 and 1805 (2) especially—(Z. C., v. 14, p. 393) Santini, writing on the 2nd April, announced that he had obs it on and from the 25th March, that it had a brilliant nucleus, and seemed to be daily increasing in light—(Z. C., v. 14, p. 395) Carlini, by letter of the 9th April, said—"You are, undoubtedly, already aware that this comet is not new, that its period is $6\frac{3}{4}$ years; that it was seen in 1808," &c.—(Z. C., v. 14, p. 396) Herein is a misprint for 1805, for the comet, commonly called after Gambart or Biela, passed the P. at the end of 1805 or beginning of 1806. See Catalogue. Schumacher, in his circular letter of the 30th March, said—"I have the pleasure to announce to astronomers a new step towards a more accurate knowledge of our solar system, for which we are indebted to Clausen. In computing the orbit of the comet discovered by Biela on the 27th February, . . . he recognised it to be the same as that of 1805, and also the same as that of 1772 . . . Gauss has proved that the comet of 1772 cannot be identical with that of 1805, without its having passed, in the interval, between these two apparitions, so near to a great planet, that the perturbations caused by the latter would explain the discrepancy between the elements Thus it is precisely, as Olbers remarked, that Clausen's elements very well explain this Supposing the comet of 1772 to have had a period of 2438 days, it must have been exposed for a considerable time in 1782, and still more so in 1794, to the

influence of Jupiter."—(Z. C., v. 14, pp. 397–8) See an interesting letter from Valz, in Z. C., v. 15, pp. 87–90. See also one from Biela, in A. J., 1829, pp. 114–119. Olbers wrote on the 24th April thus.—“What makes the comet discovered by Biela on the 27th February so particularly remarkable to an inhabitant of the earth, is the very near approach of its orbit, at its descending node, to the earth’s orbit.”—(A. N., No. 95.) Clausen’s first orbit, given in the Catalogue, yields a period of 6 674 years, and Gambart’s, 6 737 years.

1826 (2).—D. by Pons, on 6–7 November, 1825, in Eridanus. He described it to be small, round, *skorn*, and *shaved up to the ears*. of a faintish white, pretty dense in the centre, and seeming to have a nucleus, but neither sparkle nor glimmer, and added, that he had never seen one more faint.—(Z. C., v. 13, pp. 597–8.) Again he wrote to communicate his fears regarding it, viz. that it would be drowned in Eridanus, and not be seen again, as the sky had been overcast ever since it entered this constellation.—(Z. C., v. 13, p. 599) Had he written from the interior of Ireland, there would have been little to fear, for he might have been quite sure of it. Pons once more returned to his noyade (if it be permitted to use the word *singularly* applied,) on the 17th December, and said, “At last, news of the Eridanus comet! It is neither drowned nor lost” He had not seen it from the 9th to the 16th December—(Z. C., v. 14, p. 85) Again, on the 5th January, 1826, he remarked, that the centre was more apparent, and seemed to form a nucleus, but which was not at that time either brilliant or luminous.—(Z. C., v. 14, p. 87) Clausen’s elliptic orbit gives a period of 265 years.—(Z. C., v. 14, p. 173; A. N., No. 90) It was obs. by Capelli, up to the 7th April, at the Brera Observatory, in Milan.—(Z. C., v. 14, p. 490) See A. N., No. 91. This comet seems to have had the merit of puzzling the computers.

1826 (3).—D. by Flaugergues, on the 29th March, in Orion. It was found during a search for 1826 (1). It appeared like a white point surrounded by a pale and confused nebulosity. Flaugergues stated, that the comet, which was very faint at the time of its discovery, continued to become fainter until the 6th April, after which he had not seen it—(A. N., No. 120)

1826 (4).—D. by Pons, on the 7th August, in Eridanus. Inghirami, writing on the 11th August, called it a very small comet, without nucleus, and extremely difficult to observe. Gambart, on the 15th, described it to be small, round, and without nucleus. Harding, on the 4th September, said that it was pretty bright, with visible nucleus, and some trace of a tail.—(A. N., No. 106.) Olbers gave the same description of it. It was visible until October. M. Rümker’s obs. on this comet are to be found in P. T., 1829, pp. 65–67.

1826 (5).—D. by Pons, on the 22nd October, in Bootes. Clausen

detected it on the 26th, and Gambart on the 28th. The last-named signalized it as pretty bright, and accompanied by a faint light, in the form of a tail—(A. N., No. 111) Inghnam stated, on the 9th December, that it must have passed across the Sun on the morning of the 18th November, but that continued unfavourable weather prevented his witnessing the phenomenon. He added, that it was visible to the naked eye, and with a beautiful train—(A. N., No. 114) Argelander, writing on the 27th January, 1827, said, that during the preceding days it was exceedingly pale, although the tail extended to from 15' to 20'.—(A. N., No. 117) Capocci conjectured its identity with the comet of 1582, but Clausen showed that this could not be the case—(A. N., No. 114)

1827 (1)—D. by the indefatigable Pons, on the 26th December, 1826, in Hercules Harding, on the 18th January, 1827, described it as a small, but very bright nebulosity, without nucleus, but having a short tail—(A. N., No. 114.) Schwarzenbrunner, writing on the 27th January, stated, that it was without tail—(A. N., No. 116)

1827 (2).—D. by Pons, of course, on the 20th June, in Cassiopeia—(A. N., Nos. 128 and 134) He described it as having been extremely faint

1827 (3)—D. by Pons, on the 2nd August, in the Lynx.—(A. N., No. 123) Schwerd considered it to be identical with 1780 (1)—(A. N., No. 120) Olbers, writing under date, September 3rd, seemed to be of the same opinion, (A. N., No. 123,) but subsequently renounced it.—(A. N., No. 127) Schwerd observed that this comet would bear little illumination, so that he had some difficulty in observing it well Nicolai doubted the above-mentioned identity, on account of the considerable difference between the places of the nodes. He stated that this comet was pretty bright, of about 4' diameter, and with a faint appearance of a tail—(A. N., No. 123.) Valz had some suspicion of the identity.—(A. N., No. 132.) Clünnen's elliptic orbit gives a period of 2611 years.

1829.—Seventh known appearance of Encke's comet. D. by Struve on the 13th October, 1828, obs. by Kunowsky on 27th October, and 4th and 5th November, and by Eneke on 10th and 13th November—(A. N., No. 140.) Harding, of Gottingen, who had sought for it from the 19th August, saw it, for the first time, on the 27th October. Gambart, at Marseilles, saw it on the same day, but could not obs. it on account of its faintness. On the 28th he compared it with 78 Pegasi. Sir James South, at Kensington, found it on the 30th October. Olbers on the 2nd November. On the 10th he wrote to say, that it had evidently increased in strength and brilliancy of light, and was very large and striking, as seen in the comet-seeker; in a telescope, by Dollond, pale and undefined, and, therefore, difficult to obs. He

1830 (2) —D. by Herapath, on the 7th January, 1831, in Ophiuchus, and by Biela on the 14th, or rather he first *obs* it at that date; for, writing on the 15th, he stated that he had seen it for some days before sunrise, and that its tail extended to $2\frac{1}{2}^{\circ}$.—(A. N., No 192.) Nicolai gave its diameter = 3' or 4'.—(A. N., No. 201.)

1832 (1) —Eighth known appearance of Encke's comet D. supposed to have been Henderson, who obs. it at the Cape —(A. N, No 251) See note on 1819 (1).

1832 (2) —D. by Gambart, on the 19th July, in Hercules. It had neither nucleus nor tail, and would, with difficulty, bear illuminated lines Harding detected it on the 29th, without knowledge of its prior discovery At this period it showed a somewhat bright point in its centre, but no trace of tail —(A. N, No 230-232.) Heiligenstein remarked a similarity between the elements of this comet and those of 1822 (3) —(A. N., No 232) The similitude exists to a certain extent, but is not very strong, and the great inclination militates against the probability of its being a comet of so short a period.

1832 (3) —Fourth known appearance of Gambart's or Biela's comet D. by the Roman astronomers, on the 25th August, in Auriga. Its light was feeble. On the 28th it was brighter, and could be better obs.—(A. N, No. 234) Sir J Herschel stated that on the 24th 25th September it was a bright object —(A. N., No. 236) It was very generally and satisfactorily obs. all over Europe, and also by Henderson, at the Cape —(A. N., Nos. 242-257) See also P. T., 1833, pp. 549-558) Struve obs its conjunction with a star of 9th mag., on the 6th November The centre of the comet passed exactly over the star, by which its lustre was not in the slightest degree diminished, nor was there any perceivable refraction.—(A. N., No. 216) See R. A. S. Notices, vol. 2, No 15 Santini's orbit gives a period of 6.6514 years, and that of Baranowski the same.

1833.—D. by Dunlop, at Paramatta, in the month of September, in Libra —(A. N, No. 271) There is no description of this comet in the Maskree Observatory

1834 —D by Gambart, on the 8th March, in Sagittarius. Its diameter was about 4' or 5', and it was round, and of faint light —(A. N., No. 261.) This comet was also discovered at Paramatta, by Dunlop, eight days after Gambart —(A. N, No. 271.)

1835 (1) —D by Bogulawski, on the 20th 21st April, on the borders of Corvus and Cratera. He described it as round, small, and very faint —(A. N, No. 279) Bessel, in a letter dated 3rd May, added, "without tail."—(A. N., No. 280.) It was very generally obs. up to the 27th May.

1835 (2).—Ninth known appearance of Encke's comet. D by

Bogulawski on the 30th 31st July, in Gemini.—(A. N., No. 288) Encke computed the elements prospectively for this apparition.—(A. N., No. 275.) Kreil obs. it for six nights at Milan, between 22nd July and 7th August.—(A. N., Nos. 299–312.) In the sitting of the French Academy, of the 7th September, it was stated that no orbit had then been computed from Bogulawski's obs., which were supposed to have been the only ones made in Europe.—(C. R., v. 1, p. 96) See note on 1819 (1)

1835 (3) —The sixth well-ascertained apparition of Halley's comet. D. by Dumouchel, at Rome, on the 6th August, in Taurus.—(A. N., No. 289) This ardently-looked-for comet was subsequently detected by Struve, at Dorpat, on the 20th 21st August; by Bogulawski, at Breslau; Kunowski, in Berlin; Koller and Stampfer, in Kremmunster; and Littrow, in Vienna, on 21st 22nd, by Hussey, in Kent, on 22nd 23rd, by South, at Kensington, on 23rd 24th, by Petersen, in Altona, on 24th 25th, by Bessel, in Königsberg, and the compiler of these notes, at Markree, on 25th 26th, and by Rumker, in Ham-burgh, on the 28th. Any description of this well-known and splendid subject of our solar system that would be at all acceptable to the public, would be quite too extended to be admissible in these notes; but reference must be made to the astonishing and interesting facts detailed by Sir John Herschel, in his magnificent work, entitled "Results of Observations made at the Cape of Good Hope," and also to the various communications made to the French Academy, and inserted in the *Comptes Rendus*, in vols. 1, 2, 3, 5, 16, and 23. The splendid drawings by F. J. W. Struve are appended to the "*Beobachtungen des Halleyschen Cometen bei seinem Erscheinen im Jahre, 1835. Petersburg, 1839.*" Schwabe, of Dessau, gave drawings of this comet in a plate prefixed to A. N., No. 288. Bessel's extraordinary delineations are affixed to A. N., No. 302, to all of which works the reader is referred. Let us merely add one period of the comet, derived from Westphaler's second orbit, viz., 76.2907 years.

1838.—Tenth known appearance of Encke's comet. D. by Bogulawski on the 14th August (A. N., No. 357), and found by Galle on the 16th September.—(A. N., No. 361) Bremicker's elements were originally deduced from 10 years' obs. (1819–1828)—(A. N., No. 353.) After the present apparition the mean anomaly was diminished by 50", in order to reconcile the orbit with the obs. places.—(A. N., No. 375) The orbit, thus corrected, is the first in the Catalogue. Bogulawski described it to have been shapeless, extremely faint, and difficult to distinguish on its discovery.—(C. R., v. 7, p. 536) The ephemeris of Bremicker, deduced from his orbit, gave an excess in right ascension over the obs. places, and a higher declination than the true

but the errors were very small.—(C. R., v. 7, p. 688.) See same vol., pp. 795-6, 898-974.

1840 (1).—D by Galle, on the 3rd December, 1839, in Virgo, who stated that it had a very well defined point in the interior of its otherwise pretty uniform nebulosity, and with a tail-like extension opposed to the Sun.—(A. N., No. 387) Koller mentioned having seen it with the naked eye on the 8th January, 1840, as a nebulous star of from 4th to 5th magnitude —(A. N., No. 394.) This comet was in the part of its orbit nearest to the earth on the 10th December, 1839.—(C. R., v 9, p. 824.) Wolfers made the singular remark that the P. D. node and inclination of this comet were closely the same as those of the comet of 1764, the L. P., however, differing 180° , and the motion of the comet in 1764 being retrograde, while that of this comet was direct.—(C. R., v. 10, p 115)

1840 (2) —D. by Galle on the 25th January, in Draco. He stated that it was considerably faint, without apparent tail, and the portion of greatest brilliancy of the nebulosity somewhat eccentric.—(A. N., No. 392, Beilage.) Plantamour gave precisely the same account of the appearance of this comet, adding that it was lost to view at the end of March, owing to its slight elongation from the Sun, and its great distance from the earth, after having traversed an arc of about 63° . It was always invisible to the naked eye, and never showed any trace of tail. He also remarked that it presented a new example of that augmentation of intrinsic light which these celestial bodies exhibit on their greatest proximity to the Sun, and which arises, in some instances, in a single day, as Bessel obs in Halley's comet —(A. N., No. 475.) Our Catalogue gives an elliptic orbit computed by Plantamour, but it would appear that he did not place much confidence in it The period deduced from it is *only* 13864 years! Rigault claimed priority over Galle in the discovery of this comet, but as he does not seem to have made any obs, it can hardly be conceded to him by scientific men —(C. R., v 10, p. 376.)

1840 (3).—D. by Galle on the 6th March, in Cygnus. It was distinguished by a tail of several degrees in length. The first approximation to its orbit, made by Petersen, gave suspicion of its identity with the comet of 1097. Galle had, however, anticipated Petersen in this remark, and added that in 1468 also, a comet with a long tail was seen, and that he thought that a period of about 370 years was very probable.—(A. N., No 396.) The comet here alluded to is 1468 (2) in Pingré, and the elements of whose orbit by Laugier and Valz are given in the present Catalogue. The two computers agree so well under the circumstances, and their elements differ so widely from those of either 1097 or the present comet, that there seems no room to doubt

that the comet 1468 (2) was distinct from both. Encke, writing under date of 24th March, expressed the same opinion as Galle with reference to the identity of this comet with 1468 (2), ascribing to it a period of 371 years—(A N, No. 399) Galle stated that this comet passed very near to Jupiter in the preceding year—(A N, No. 400.) In a letter to Humboldt, announcing his discovery, Galle assigned to the tail a length of 3° —(C R, v 10, p. 467) Again, Humboldt, in a letter to Arago, communicated to the French Academy, in their sitting of the 30th of March, stated his concurrence with the opinions of the above-named astronomers, and also that at the date of his letter the tail of the comet was 5° in length, and that it was accompanied by two secondary tails, and added that, according to some observers, the comet of 1097 had a secondary tail.—(C R, v 10, p 535.)

1840 (4)—D by Bremicker, on the 26th October, in Draco Clouds prevented his giving it a *character* upon this occasion —(A N., No. 412.) Santini, under date, the 8th December, described it as very faint and difficult to observe presenting the aspect of a mass of vapour feebly illuminated —(A N, No 414) Koller stated, that on the 22nd 23rd January, 1841, a mere trace alone of the comet was visible in his telescope —(A N, No 420) Gotze's 1st elliptic elements give a period of about 360 years Encke had remarked that the obs did not accord well with a parabola —(A. N., No. 503) Gotze's 2nd set assign a period to this comet of 344.3 years —(A. N., No 519)

1842 (1).—Eleventh known appearance of Encke's comet. D by Valz, on the 9th March —(C. R., v. 14, p. 407.) and afterwards found by Laugier and Mauvais on the 12th March, in Pisces. It was stated to have been faint, but, nevertheless, a condensation of light was perceivable in the centre Its diameter was estimated at from $2'$ to $3'$. (C. R, v. 14, p 406) It was obs on and after the 27th March by Walker and Kendall, in Philadelphia.—(A. N., No. 495) Also on the 28th March, and subsequently at Hudson's Observatory, in the United States, by Loomis —(A N., No 517.) Also on and after the 14th March, by Plantamoor, at Geneva.—(A N, No. 524) We have no orbit computed from this year's obs in the Markree Observatory; that given was therefore prospective. See note on 1819 (1)

1842 (2)—D. by Laugier, on the 28th October, in Draco He called it extremely faint, and without tail —(A N., No. 461.) Kaiser could see no nucleus up to the 12th November.—(A. N, No 463) Argelander stated, that on the 5th November, a mere trace only of tail could be perceived, but that on the 6th it was distinguishable to a length of from $12'$ to $15'$; then moonlight effaced it until the 21st, when it re-appeared. Valz saw it on the 21st and 24th November as a star of 7th mag., without tail or nucleus, but having a condensation

of light in the centre of a somewhat extensive nebulosity—(A. N., No. 466) Laugier conceived some resemblance between this comet and one observed in China, 1301 (2). Speaking after the 5th November, he said that for some days a small nucleus had been remarked, becoming more and more brilliant, that the tail had not increased since the 2nd November, that it was scarcely 10' in length, and that the diameter of the nebulosity was about 5'.—(C. R., v. 15, p. 896.) Schumacher obs., in a letter to Arago, that the I and P. D. of this comet were nearly the same as those of the comet 1780 (2), but Laugier did not think this sufficient to identify the two comets; and having carefully examined the data for an orbit of 1301 (2), and computed the elements, he finally rejected the idea of any identity.—(C. R., v. 15, pp. 949-950)

1843 (1)—D. u. The idea of compressing an account of this magnificent and extraordinary phenomenon, within the compass of an ordinary note, is preposterous, and it would be equally so to reject a description of it on this ground. Indulgence, therefore, is craved at the outset. The two facts connected with this comet, of, probably, most interest to the public, are 1st, that the trajectory of the comet was such, that very little faith can be placed in any computation of its period of revolution 2ndly, that from obs. of the comet, with very imperfect means of making them, a very tolerable orbit was deduced. Before touching on these points, it is desirable to detail the history of its apparition.

February 27th.—It was seen at Conception, in South America, at 11 A.M., by Captain Ray, who estimated its distance from the Sun = 5', or one-sixth of the Sun's apparent diameter.

February 28th.—It was obs. by Captain Clarke, of Portland, as follows:—At 3^h 2^m 15^s P.M., Sun's farthest limb from nearest limb of nucleus = 4° 6' 15", at 3^h 6^m 20^s P.M., Sun's farthest limb from farthest limb of nucleus = 4° 7' 30"; at 3^h 9^m 40^s P.M., Sun's farthest limb from extremity of tail = 5° 6' 30".—(See R. Ast. Soc. Notices, v. 6, No. 3.) On the same day it was obs. by Mr. Bowring, in Mexico He gave the following statement —

At 1^h 2^m 53^s.5 P.M., double alt. of comet = 101° 1' 0". Mean of 5 obs.

„ 2^h 2^m 27^s „ „ = 84° 41' 27". „ 3 obs.

„ 2^h 10^m 37^s „ „ = 79° 0' 14". „ 5 obs.

Mr. Bowring added that the error of the sextant = + 40", and that the rate of the watch = - 1^m 15^s daily. The comet was also seen on this day by a multitude of persons in America, a few in Europe, and throughout the southern hemisphere, and on the evening of each succeeding day, for a month, its magnificent train excited the wonder and admiration of countless numbers.—(Cambridge, U. S. A. Astron.

Journal, No 2) After having detailed some obs. of the comet, Bianchi wrote as follows, under date 27th May.—“I now call your attention to the truly singular and beautiful phenomenon obs. by many persons, and in many parts of Italy, fifteen days and more before the appearance of the great comet. It was on the 28th. February, and the sky, until noon, being perfectly clear, a species of star was seen by many people at Bologna and Parma, at the Villa Colonna, and at Genoa, between $10^h 45^m$ and $11^h 45^m$ A.M., at a little distance eastward of the Sun, and which shone very brilliantly, notwithstanding the apparent proximity of the Sun, requiring the latter only to be kept out of the direct line of sight by the intervention of a wall. From this star a tail equally brilliant, shot out, and was visible towards the east to the distance of 4° or 5° .—(A. N., No. 483.) First seen at this date in the Isle of France, the tail being described to resemble a stream of fire from a furnace.—(A. N., No 491.) Also first perceived at this date at Mines de Guadalupe y Calvo in Mexico, by M. Bowring. It was visible from 9 A.M. to sunset. He took double altitudes of the comet and Sun, and estimated the length of the tail at 34° .—(C. R., v. 17, pp 85-599.)

March 1st—Seen first at Copapo, in Chili, by M. Charles Darlu. The tail appeared to be 30° in length, and seemed to increase in brilliancy up to the 15th, after which its light gradually diminished, but not its apparent extent. During the first three days of obs., there was, in addition to the principal tail proceeding from the nucleus, a second, starting near a point about one-third of the length of the former (from the nucleus), and extending much farther than the first.—(C. R., v. 17, p. 362.) Seen also at Pernambuco, by Mr. Cowper —(R. A. S. Notices, v. 5, No. 32)

March 3rd, 4th.—The double tail seen at Monte Video, by Dr. Martin de Moussy, who described it to have been *beside* the large tail, but of less dimensions, and not attached at any point to the former.—(C. R., v. 21, p 774) This account agrees very well with that of M. Charles Darlu, excepting, possibly, as to the dimensions of the tail.

March 4th.—First seen at Bombay —(A. N., No. 491.) Also at Trevandrum, by Mr. J. Calder. Writing on the 19th April, he said that on the previous night the length of the tail = 45° , as measured by a sextant, the diameter of the planetary part of the nucleus = $11''$, the breadth of the tail at one-third of its length from the nucleus = $33'$, and at two-thirds, about 1° .—(A. N., No. 495) Nucleus seen also by Mr. Cowper, at Pernambuco —(R. A. S. Notices, v 5, No. 32.)

March 5th—Seen at Cuba.—(C. R., v. 16, p. 723)

March 8th.—First remarked at Lisbon.—(A. N., No. 484.) On the evening of this day Mr. Bowring, in Mexico, estimated the length of the visible portion of the tail to be = 35° .—(C. R., v. 17, p. 85.)

March 11th.—Nucleus seen by Loomis, at Hudson, and by Walker and Kendall, in Philadelphia.—(Cambridge U. S. A. Ast. Journal, No. 2, and A. N., No. 577) Also obs by Franzini, at Lisbon, and the length of the tail estimated to be $= 36^\circ$, and its breadth $= 30'$.—(A. N., 484) Seen at this date by Legrand, at Montpelier. He attributed to it a strong reddish colour upon this occasion, and also on the 13th — (C. R., v. 16, p 928.) The writer of these notes is obliged to question the accuracy of this latter conjecture, having himself, *on the same night*, noted the fact of the remarkable whiteness of the comet's light, compared with that of the zodiacal light, which was at the time beautifully developed.

March 12th.—The compiler of these notes was at Nice Maritime, and his attention was first called to this phenomenon on the evening of this day. He will not now repeat what appeared at the time in the public journals, relative to the circumstances which prevented his efficient obs. of it, but detail hereafter the mode adopted to render somewhat serviceable, obs. made with an ordinary small telescope, having an object-glass of two inches diameter, and without any micrometrical apparatus, aided by a good watch, and an eight-inch transit. From a conversation he held with the Marquis de Choiseul, several days afterwards, he is convinced that that nobleman, and several of his friends, saw the tail on the evening of the 9th, when descending the hills in the neighbourhood of Nice, and he is also quite satisfied that one of his (the writer's) servants perceived it first three or four days prior to the 9th.

March 13th.—Remarked at Nice, for the second time, by the writer, and, as it retained its position relatively to the setting stars, he ascertained that it could be no atmospheric phenomenon, and saw that it was clearly distinguishable from the zodiacal light. The direction of the tail was parallel to the equator, and it stretched out under the line joining η Leporis with γ Eridani. An attempt to discover the nucleus, this evening, failed — (See A. N., No. 474)

March 14th.—Having still a persuasion that the object before him was the tail of a comet, he again swept down the line of light with the small telescope, and discovered the nucleus. It appeared like a star of the 6th magnitude, and the coma was brilliant. The tail rested upon γ Eridani, and its length was about 45° .—(See A. N., No. 474) Unfortunately no diagram could be made, there being only one star visible in the field with the nucleus.

March 17th.—This was the great day of discovery throughout Europe. Sir John Herschel saw it, and estimated the length of tail to be $= 30^\circ$, and its breadth $= 1^\circ 30'$. Seen first, also, at Geneva, by Plantamoor. Also by de Vico, at Rome, who remarked a singular

scintillation in the nucleus—(A. N., No. 474.) By Argelander, at Bonn, and Nicolai, at Manheim.—(A. N., No. 475.) By Capocci, at Naples.—(A. N., No. 477.) Again at Paris, Brest, Tours, Sens, Ferté sous Jouarre, Rheims, Neufchatel in Switzerland, Salms, Marcillac, &c., &c. The weather was such, in Paris, that it could not have been seen from the 8th to the 15th inclusive. From a letter received from M. Lalesque, at the Tête de Buch, it appears that it was remarked there so early as the 8th. The nucleus was not perceivable in Paris until the 18th. The tail was estimated, on this day (17th), to be 39° or 40° in length, and its breadth to be about 1° . On the following day it was concluded to be 43° long, and slightly curved—the convexity being towards the North. On the 19th the length of the tail was $41^{\circ} 30'$, and its breadth about $1^{\circ} 15'$.—(C. R., v. 16, pp. 597–600.)

March 18th.—First seen by Littrow, at Vienna. He considered the tail to be 40° long, and 1° broad.

March 19th.—Obs. by Knorre, at Nicolajew. He estimated the tail, on the 17th, to be $46^{\circ} 10'$ long, and its greatest breadth = $1^{\circ} 30'$.—(A. N., No. 477.) Also first seen, at this date, by Köller, at Krennmünster.—(A. N., No. 504.)

March 20th.—Galle, at Berlin, first saw the head, in the twilight, and estimated the length of the tail to be = 40° . Cooper wrote on this day to Schumacher, to express his opinion of the identity of this comet with those of 1668 and 1702. Encke also obs. it, first, on this day.

March 25th.—Obs. by Kreil, at Prague.

March 26th.—By Bessel, at Königsberg. He remarked that the light of the comet had, as had been previously announced by Cooper, very rapidly declined.—(A. N., No. 474.)

November 16th.—Sir John Herschel reported his receipt of a letter from India, assuring him that Mr Clerihew had obs. but one tail appended to this comet from the 6th March, but that on the 11th March it had two—the second being nearly twice the length of the first, but fainter.—(A. N., No. 493.)

Having now related the successive discoveries of this extraordinary phenomenon, and noticed the principal details of its physical appearance, let us proceed to examine the state of the question as to its identity with any comet previously seen, and as to its probable period of revolution.

In the sitting of the French Academy of Sciences, on the 27th March, 1843, M. Arago stated the points of similarity between this comet and those of 1668 and 1702, and conferred upon the compiler of these notes the honour of noticing his letter from Nice, dated on the 20th March, in which he offered his opinion that the present comet was identical with that of 1702. This letter is published in the C. R., and M. Arago

is stated to have said :—"Sans avoir eu l'occasion de prendre une connaissance détaillée des mémoires que nous venons d'analyser, M. Edward Cooper s'est cru autorisé à présenter la comète de 1843 comme une réapparition de celle d'Aristote, de Cassini, et de Maraldi"—(C. R., v 16, p 607) Again in the sitting of the Academy, on the 10th April, M. Arago stated:—"MM. Laugier et Victor Mauvais ont cherché si les déterminations précises calculables, ne pourraient pas être substitués aux considérations vagues d'après lesquelles M. Cooper s'est persuadé que la comète de 1843, les comètes vues en 1702 par Maraldi, et en 1688 (misprint for 1668) par Cassini ne seraient qu'un seul et même astre."—(C. R., v 16, p 720) One or two remarks may be here deemed excusable. The comet was first seen by Cooper on the 12th, and he had had several opportunities of judging its course between that date and the 20th (the date of his letter). He saw it in the same month, and in the same constellations as were assigned by Maraldi in his communication upon the comet of 1702. He saw it also with the nucleus "toujours plongée dans les rayons du Soleil," and had remarked its diminishing light, as well as its very slightly increasing angular distance from the Sun. He predicted that, probably, it would not be visible in the north of Europe, nor any where for any length of time, in consequence of the above-mentioned facts; and Bessel noticed the correctness of his prediction. On the 31st March Schumacher rejected the idea of the identity of this comet with that of 1702, but seemed to think it very probable that it was the same as that of 1668.—(A. N., No 480) Henderson wrote, on the 11th April, to say, that he thought that there was a great probability in favour of the supposition that this comet and the one that appeared in 1668 were the same.—(A. N., No. 476) Clausen stated, on the 21st April, that it did not appear to him to be quite impossible that the period of the comet might be 21 years 10 months, identifying it with those of 1668 and 1689.—(A. N., No. 485) On the 24th April Nicolai joined those who were of opinion that this comet was identical with either 1668 or 1702, or with both.—(A. N., No. 477.) On the 27th, Kendall seemed to lean to the suspicion that this comet was the same as that of 1689.—(A. N., No. 480) On the 23rd May, Walker, of Philadelphia, produced an hyperbolic orbit, computed by Gauss's method, for any conic section.—(A. N., No. 487.) On the 5th September, Capocci assigned to this comet a period of only 7 years.—(A. N., No 490) See R A S Notices, v. 5, No 32

1845—July 18th.—Bogulawski appeared to favour the conjecture, that the period = 147 years, 4 months.—(A. N., No. 545.) Plantamoor's first elements gave for P. D. 0.0045, being 0.0001 less than the solar radius.—(C. R., v. 16, p. 609.) On the 24th March, 1843, Encke assigned 0.0101 to P. D. Galle on the 25th 0.0113, and Littrow

0.5767, in which there must be some error. On the 3rd April, E. Bouvard 0.00488, and Laugier and Mauvais 0.005488. Arago remarked that, assuming this last determination to be definitive, as every thing authorized him to do, this comet approached the nearest of all known to the Sun. On the 28th March, the diameter of the nebosity forming the head = $2' 40''$, which corresponds to a real diameter of 38,000 leagues, and to a volume 1700 times that of the earth. On the 18th March the angular dimension of the tail = 40° , and the absolute length = 60 millions of leagues. Between the 27th and 28th February the comet traversed 292° on its orbit. It was also twice in conjunction with the Sun on the 27th February. The real semi-diameter of the tail = 660000 leagues, and the nearest distance of the earth from the edge of the tail = 8 millions of leagues — (C. R., v. 16, pp. 640–643.) The result of the inquiry instituted by MM. Laugier and Mauvais, into the probability of this comet being identical with those of 1668 and 1702 is thus reported:—"After this exposition, it is doubtful that the comet of 1843 and that of 1702, are one and the same, but it appears extremely probable that the present comet was obs. in 1668." Schumacher came to the same conclusion, and assigned in consequence of his opinion, a period of 175 years — (C. R., v. 16, pp. 772–3.) Laugier and Mauvais having assumed a period of about 35 years for this comet, and retracing century after century, the various apparitions of these phenomena, noticed several, which they considered to offer a certain analogy to the present. These were in 1702, 1668, 1528, 1492, 1457, 1106, 1001, 685, 580, 369, 335, 194, 159, and — 367. They remarked that the comet of 1106 was the only one of which we know the path from cotemporary historians, and they showed that the accounts of it agreed very well with that of the present comet. — (C. R., v. 16, pp. 919–924.) Valz, after inquiring into the obs. made of the comet of 1668, appears to have been satisfied that the present comet was the same. — (C. R., v. 16, p. 925.) He also quoted the words of Pingré upon the comet of — 371, which are certainly very remarkable, and give great support to the presumption, that that comet and this which is under discussion were identical. He also appears to have accounted pretty satisfactorily for the fact of the comet of 1702 not having been seen again until 1843; assuming that these two comets were also one and the same. He supposed an augmentation of six months in each revolution, founded upon a theory which he offers; and upon this supposition he stated that the comet would have been in P. in September, 1736, and must have been invisible in Europe; again in P., in September, 1771, and again invisible in Europe.

Lastly, in P., in March, 1807, visible in Europe, but for so short a

time, that it is not surprising that the usual bad weather at that season might have prevented its being seen.—(C. R., v. 16, pp. 924-928.) This paper, by Valz, is extremely interesting, but too long to transcribe.

That this comet is in many respects the most interesting of any on record, whose orbit is yet uncertain, will scarcely be questioned. When all the conic sections have been deduced from the obs and ellipses computed or conjectured from 175 years to seven year periods: when the extent of the orbit visible to the inhabitants of our planet, for the major portion of the apparition, was so nearly rectilinear, and when it is considered that the few obs. made near the P. were so rudely obtained; whereas the least error at this time would enormously affect any resulting elements; it will hardly be less questioned that the best orbit existing, cannot, so far as its major axis is concerned, bring conviction of its accuracy to the mind. Under such circumstances what better can be done than to conjecture? The criticised example of the writer has been followed by others of far higher reputation than his in the astronomical world, which has induced him to persevere in the only course open to him under all the circumstances: however fallacious, strictly speaking, may be the argument; and the following plan of proceeding was adopted. Pingré was, of course, the text-book, and his entire list examined; from which were selected all those comets, the records of which bore testimony of *possible* identity with the present. One word of explanation. The term "possible" is not to be strictly interpreted, as several comets were rejected, either from want of any description, or from such as was given appearing to the writer's judgment to militate against the identity, although admissible in reference to the time of their appearance. Thus, the comets of years 159, 194, 685, and 1457 have been omitted, which would have much favoured the period of revolution originally conjectured by the writer. This process had some analogy with Fraunhofer's practice of cutting up his flint-glass castings into prisms, and grouping all those whose refractions were within a given limit. The entire list of selected comets were then sub divided into three classes, viz:—"Very probable;" "not improbable," and "possible." Of the "very probable," there appeared to be nine cases; of the "not improbable," fifteen, and of the "possible," twenty-three. The next step was to compute the times of each apparition of the comet upon the several suppositions of periods, namely, Laugier and Mauvais, of 175 years; Bogulawski's, of $147\frac{1}{2}$ years; Laugier and Mauvais, of 35.1 years; and Clausen, of $21\frac{1}{2}$ years. The comets selected from Pingré and Biot (one), were then compared with the tables of computed apparitions. The margin of difference allowed in every case was five years. From this proceeding

there appeared in favour of 175 years two coincidences of the 1st class, one of the 2nd, and one of the 3rd. In favour of $147\frac{1}{2}$ years there appeared three of the 1st class, none of the 2nd, and one of the 3rd. In favour of 35 1 years, six of the 1st class, four of the 2nd, and three of the 3rd. Lastly, in favour of $21\frac{1}{2}$ years, there were four of the 1st class, eight of the 2nd, and eleven of the 3rd.

Having obtained this first approximate result from comparison of the recorded comets with the computed apparitions derived from the above-mentioned orbits, the intervals between the recorded comets were tested, which caused the rejection of one of the 1st class in connexion with the orbit of 175 years, and that of one of the 1st, two of the 2nd, and two of the 3rd class, from those at first supposed to support the period of $21\frac{1}{2}$ years. This revision left the comparison as follows:—

Period 175 years.

From - 1770 to + 1843 = $20\frac{2}{3}$ revolutions.

Class.	From	To	Interval.	Rev.	Years.	
3.	- 252 +	1313	= 1565	= 9	of 174.89	Mean 174.58
2.	+ 1313	1668	= 355	= 2	177.50	
1.	1668	1843	= 175	= 1	175.00	

The difference between mean Rev. and assumed period = 0.42 year.

Period $147\frac{1}{2}$ years.

From - 1770 to + 1843 = $24\frac{1}{2}$ revolutions.

Class.	From	To	Interval.	Rev.	Years.	
1.	- 370 +	1106	= 1476	= 10	of 147.6	Mean 147.53
1.	+ 1106	1402	= 296	= 2	148.0	
1.	1402	1695	= 293	= 2	146.5	
3.	1695	1843	= 148	= 1	148.0	

The difference between mean Rev. and assumed period = 0.20 year.

Period 35 1 years.

From - 1770 to + 1843 = 103 revolutions.

Class.	From	To	Interval.	Rev.	Years.	
2.	- 1770 -	370	= 1400	= 40	of 35.0	Mean 35.08
1.	- 370 +	336	= 706	= 20	35.3	
3.	+ 336	582	= 246	= 7	35.14	
2.	582	1106	= 524	= 15	34.93	
1.	1106	1208	= 102	= 3	34.0	
2.	1208	1313	= 105	= 3	35.0	
2.	1313	1382	= 69	= 2	34.5	
3.	1382	1454	= 72	= 2	36.0	
1.	1454	1491	= 37	= 1	37.0	
1.	1491	1528	= 37	= 1	37.0	
3	1528	1668	= 140	= 4	35.0	
1.	1668	1702	= 34	= 1	34.0	
1.	1702	1843	= 141	= 4	35.25	

The difference between mean Rev. and assumed period = 0.02 year.

Period $21\frac{1}{2}$ years.

From - 1770 to + 1843 = $166\frac{1}{2}$ revolutions.						
Class.	From	To	Interval.	Rev.	Years.	
3.	- 252 -	183 =	69 =	3 of	23 0	} Mean 21.82
2	- 183 +	252 =	435 =	20	21 75	
3	+ 252	336 =	84 =	4	21 0	
3.	336	422 =	86 =	4	21 5	
2.	422	533 =	111 =	5	22 2	
3.	533	708 =	175 =	8	21.87	
3	708	729 =	21 =	1	21.0	
2.	729	882 =	153 =	7	21 86	
3	882	1077 =	195 =	9	21 67	
3.	1077	1208 =	131 =	6	21 83	
2.	1208	1362 =	154 =	7	22.0	
2.	1362	1382 =	20 =	1	20 0	
3.	1382	1402 =	20 =	1	20 0	
1.	1402	1491 =	89 =	4	22.25	
1.	1491	1511 =	20 =	1	20.0	
3.	1511	1668 =	157 =	7	22.43	
1.	1668	1689 =	21 =	1	21 0	
2.	1689	1843 =	154 =	7	22 0	

The difference between mean Rev. and assumed period, = 0.01 year.

From the preceding, it appears on the first assumed period rather more than one-seventh of the computed apparitions were identified; on the second period somewhat less than one-sixth, on the third, a little more than one-eighth, and on the fourth, somewhat less than one-ninth were identified. Of the two longer periods this would tend to favour the second, and of the two shorter periods, the first

Having obtained these rough data, the following weights were arbitrarily assumed for each class of comets, viz, for a first supposition, each of the comets of the 1st class = 4; second class = 2, 3rd class = 1; and again, for a second supposition, the 1st class = 16; 2nd class = 4; 3rd class = 1.

Permitting, then, an extreme difference between the period of any recorded apparition of a comet, and that which resulted from computation from any of the several orbits under consideration to be = 5 years, we have the following representation of weights of identification:—

	1st Supp.	2nd Supp.
In favour of 175 years =	7	21
147 $\frac{1}{2}$ =	13	49
35.1 =	35	115
21 $\frac{1}{2}$ =	33	81

Limiting the extreme difference to 4 years, we have—

	1st Supp.	2nd Supp.
In favour of 175 years =	4	16
147 $\frac{1}{2}$ =	13	49
35.1 =	34	114
21 $\frac{1}{2}$ =	26	60

Limiting the extreme difference to 3 years, we have—

	1st Supp.	2nd Supp.
In favour of 175 years =	4	16
147½ =	13	49
35.1 =	30	106
21½ =	26	60

Lastly, limiting the extreme difference to 2 years—

	1st Supp.	2nd Supp.
In favour of 175 years =	4	16
147½ =	9	33
35.1 =	21	81
21½ =	20	42

The result of this investigation certainly favours the presumption, that the four comets included by MM. Laugier and Mauvais, and excluded herefrom, ought to have been retained as “possible” apparitions of the present comet. There is still another view to be taken of this subject, namely, a comparison of the differences between calculation and observation applied to various orbits computed for this the great comet of 1843. The three conic sections have been found from the obs. First, let us take the parabola by MM. Laugier and Mauvais, from C. R., v. 16, pp. 640–1, which, in the sitting of the French Academy of April 3rd, 1843, was described by M. Arago to be the orbit which at that date agreed best with the obs. The means of the squares of the differences on eight comparisons are, in right asc. = 28.78, in decl. = 62.08. The next is an hyperbola by Encke, from C. R., v. 16, p. 719. The means, as before, on eleven comparisons, are—in right asc. = 27.68, in decl. = 61.61; showing so slight a difference from the parabola, that it would be indeed difficult to make a choice. There follow the two ellipses by Laugier and Mauvais. The means on seven comparisons, for that of 175 years’ period, give—in right asc. = 54.18, in decl. = 57.26; and on twelve comparisons, for that of 35.1 years—in right asc. = 36.02, in decl. = 45.85. Once more the sum of the means will be—

For the parabola =	90.86
Hyperbola =	89.29
175 years’ ellipse =	111.44
35.1 years’ ellipse =	81.87

If then the present comet be one hitherto seen, it certainly does not appear to be one of very long period of revolution.

Before the close of these lengthy remarks, it may be well to mention that Mr. Graham, to gratify his and the writer’s joint curiosity, computed the comet’s places from 16th to 30th March, both inclusive, and for 7^h 30^m, M. T. Nice, on the hypothesis of a rectilinear path; the assumed time of P. P. being February 27. 1218, taken from an orbit

computed by the writer from his own rough obs. The heliocentric L and l were similarly derived. The places thus found were compared with the rough obs. of 16th, 17th, 21st, 24th, 28th March, and 2nd April, and the arithmetical mean (without regard to the signs) of the errors of obs.—in L . $3' 12'' 9$, and in l . $3' 55''.7$ In the same way were compared 29 obs. made by Argelander, Bessel, de Vico, Encke, Plantamoor, Rumker, and Steinheil, and the result was mean of the errors of obs. in L . $2' 1'' 4$, and in l . $2' 22''.5$. When it is stated that the observers differed from one another on the same nights, and at the same times, to the extent of $6' 8''$ in L and $8' 27''$ in l , the amount of variation from the right line may be considered small. It is, at least, quite evident that an ephemeris, deduced from the assumed rectilinear path, would have shown the comet in the field of any telescope every night, during the space of time embraced. “The period deduced from Hubbard’s elements is 803 years. According to this, the least distance from the surface of the Sun, was 82250 English miles, or about one-third of the Moon’s distance from the earth.”—(A. Graham.)

The extreme length of the notes on this comet forces reference to an appendix for the mode adopted to render the crude obs. made at Nice by the writer, available for the computation of elements.

1843 (2).—D. by Mauvais, on the 2nd May, on the confines of Cygnus and Pegasus. He described its appearance to be that of a feeble, oval nebulosity, of about $3'$ diameter, with a small bright point in the centre.—(A. N., No. 479) Mauvais called attention to the fact, that the comets of 1729, 1747, and 1826, are the only ones whose P. D. exceeded that of the present comet. He also conceived that the light had slightly increased on the 11th May.—(A. N., No. 480; C. R., v. 16, p. 1091.) Köller, under date the 28th June, stated that it had the appearance of a round nebula, of about $3'$ diameter, without any perceptible nucleus or tail.—(A. N., No. 483) This comet was also obs. in America by Loomis.—(A. N., No. 517) Götze found the orbit to be hyperbolic.—(A. N., No. 533.) This comet showed itself in great contrast with the preceding, both as to P. P. and duration of visibility, and its elements may be considered to have been very well determined. It will be seen also that Santini produced an hyperbolic orbit.

1843 (3).—D. by Faye, on the 22nd November, in Orion. Under date 25th November, he stated that the comet had a very brilliant nucleus, and a fan-shaped tail about $4'$ in length.—(A. N., No. 492) Argelander, under date 3rd January, 1844, expressed an opinion that this comet was a counterpart of that of 1770 (1), and that we might thank Jupiter for its present very remarkable path, as it must have passed near to him towards the end of 1839. He then proceeded

to predict our seeing it again in 1850. Santini stated that on the first evening he saw it, it was sufficiently splendid, but on the 24th December, altogether faint, that it had a slightly nebulous aspect about $1' 30''$ in diameter, and that, towards its eastern side, at times were seen one, at others two brilliant points. It appears, from a letter of Plantamoor, that Gauss was the first to detect the nature of the orbit of this most interesting phenomenon.—(A. N., No. 495.) Otto Struve described it to be very faint on the 24th January, 1844 —(A. N., No. 497.) Plantamoor also stated, in allusion to obs. of 22nd and 25th January, that its faintness, and the rapidity of its motion from the earth, caused him to fear that he should obtain no further places of it —(A. N., No. 498) Kaiser, however, saw it on the 14th February, at Leiden. He stated, that on the 16th, it was most difficult to obs. The places were nevertheless obtained. Again he obs. it under more favourable circumstances of atmosphere on the 20th and 22nd February.—(A. N., No. 499) W. Struve obs. it to the 23rd inclusive. It was also seen at Rome to the same date.—(A. N., No. 500) It seems that Kaiser was able to detect it even to the 14th March —(A. N., No. 502) Valz identified this comet with that of 1770 (1), and said that it was abducted by Jupiter in 1779, and again restored to us by the same influence as was exerted in 1767, to bring it to our view. He remarked that, surprising as this may seem, it is not less within the range of probability, for it is sufficient that two celestial bodies should have passed into the same point, in space, to cause their continued return to that point, so long as perturbations from other sources do not displace ~~this~~ point. Thus, an approximate conjunction of two heavenly bodies having taken place, it may occur again, having regard to their respective revolutions. The comet of 1770 (1) should necessarily traverse the orbit of Jupiter in each revolution, and be there exposed to new conjunctions which might disfigure its orbit so as to preclude recognition. The reader is referred to the statement quoted.—(A. N., No 504; C.R., v. 18, p. 764.) O. Struve thought it so bright in the cometen-sucher, on the 14th 15th December, that it might be seen with the naked eye, comparing it with a star of 6th or 7th mag.; but his attempt thus to see it was unsuccessful. In February he found the diameter of the comet to be $30''$, and in April, $12''$. He measured the length of its tail, on one night only, (19th December,) and found it to be about $19''$.—(A. N., No. 505.) Henderson wrote as follows:—"In several respects this comet is very remarkable; and it may afford some room for speculation regarding its identity with the lost comet of 1770. The orbit resembles more nearly the elliptical orbits of the planets than those of the periodic comets yet known. In its aphelion and perihelion it approaches nearly the orbits of Jupiter and Mars; and it must occasionally

experience great perturbations from the former. It also passes within comparatively small distances of the orbits of the smaller planets."—(R. A. S. Notices, v. 6, No. 3.) See also C. R., v. 18, p. 186. In the sitting of the French Academy, of the 8th January, 1844, M. Arago stated that M. Faye was awaiting some further obs. to compute an elliptic orbit, the parabolic failing to represent those previously made.—(C. R., v. 18, p. 58.) It appears, from a letter to M. Couchy, that M. Leverrier anticipated the views of M. Valz, already stated.—(C. R., v. 18, p. 826.) This comet was seen, at Pulkowa, up to the 16th April, 1844.—(C. R., v. 18, p. 944.) The period deduced from the orbit of Nicolai, which appears first in the Catalogue, = 7.193 years. See 1850 (1).

1844 (1)—D. by de Vico on the 22nd August, in Aquarius. Mr. Melhop saw it for the first time on the 6th September, at Hamburg, and stated it to be visible to the naked eye, and to have had a bright nucleus and small tail.—(A. N., No. 516.) Resluber remarked, that on the 10th and 13th November it had become very faint.—(A. N., No. 526.) Hind saw it up to the 30th December, but could not obs. it that night.—(A. N., No. 536.) O. Struve was enabled to obs. it at Pulkowa to the 30th December inclusive.—(A. N., No. 592.) Leverrier rejected the idea of any identity between this comet and that of 1770 (1). Laugier and Mauvais, having computed an elliptic orbit for the comet of 1585, were of opinion that the result placed beyond all doubt the identity of that comet with the present. Leverrier found a parabola to agree at least equally well with the obs. of 1585 as the ellipse; and having examined closely into the subject, he negatived the supposition that had been adopted by the computers of the ellipse. But the same astronomer showed grounds for belief that the comet of 1678 and the present were the same, and thus concludes his paper upon the subject:—"The comet of 1844 (1) may have come, like others, from the most distant parts of space, and have been included among the planets by the powerful action of Jupiter. Its arrival was, no doubt, many centuries ago. Since that period it has very often passed into the earth's vicinity, but it has only been once obs. in past centuries, viz. 166 years preceding its present apparition."—(A. N., No. 624, C. R., v. 19, pp. 501, 701, 983.) Brunnnow calculated an ephemeris for the return of this comet in 1855.—(A. N., No. 681.) The period of revolution, according to Hind's elements = 1980 days, by Brunnnow's, 5,466 years, and by Faye's, 1993 days. It was not visible in 1850 or 1851.

The comet of 1743 (1) was included among those bearing some resemblance to the one under notice, but Laugier and Mauvais seem to have finally rejected it.—(C. R., v. 19, p. 558.)

1844 (2).—D. by Mauvais, on the 7th July, in Hercules. He

described it as pretty bright, of about 3' diameter, and with a small brilliant nucleus. It was also detected on the 9th, by d'Arrest. On the 14th Sir James South stated it to be very faint —(A. N., No. 511; C. R., v. 19, pp. 85 and 239.) In a letter, dated the 14th July, Mauvais remarked, that this comet was one of those passing nearest to the orbit of the earth.—(A. N., No. 512.) Mr. Gillip, of Washington, U. S. A. stated, that on the 16th and 17th August, its nucleus did not appear larger than a star of the 9th mag., with a nebulosity of about 2' diameter. A tail 6' in length was suspected at the obs. of the 17th, but unfavourable weather prevented its confirmation.—(A. N., No. 517.) It was obs. at the Cape of Good Hope in October, and up to the 2nd November, inclusive.—(A. N., No. 526.) Rumker obs. it on the 8th February, 1845.—(A. N., No. 528, Supp.) This comet was obs. by the writer, and Mr. Graham, near Innspruck, in 1844, and elements were computed by both observers. It was again obs. by the writer, at Naples, on the 7th February, 1845, the same night that the comet 1844 (3) was first seen by him. The present comet had been re-detected some nights earlier. The writer and Mr. Graham obs. it for the last time on the 26th February. Nicolai obs. it on the 4th, 8th, and 10th February. Brünnow and d'Arrest found the comet 1844 (3) on the 25th February, in looking for the present. It was obs. by Santini on the 25th February.—(A. N., No. 530.) Also at the Cape of Good Hope from the 11th to the 21st November, 1844, both inclusive, and from the 16th of February to the 10th March, 1845 —(A. N., Nos 536 and 539) It was obs. at Berlin on the 6th March, (A. N., No. 540,) and at Geneva, Kremsünster, Vienna, and other places after the P. P. Also at Königsberg up to the 9th March, inclusive. This comet traversed the ecliptic, at the distance of about twelve millions of miles from the terrestrial path, and was discovered three months before its P. P.—(C. R., v. 19, pp. 162–3.) Argelander appears to have been the first to detect it (on the 31st January) after its emergence from the Solar rays.—(C. R., v. 20, p. 451.) Maclear, at the Cape mentioned that it was first seen on the 27th October; that it appeared as a faint nebulous patch of light, nearly circular, about 1' in diameter, and with a condensation of light near its centre. On the 3rd November it was a fine nebulous mass of light: the outline seeming to be of a parabolic figure, having the condensation in its focus. A faint trace of tail was seen, about 4' in length; its direction being *apparently* towards the Sun. On the 8th November a distinct nucleus, about as bright as a star of the 9th mag., was visible in the most brilliant part of the head. The length of the tail was about 9', its light being very faint. The comet was, on the 10th November, visible to the naked eye.—(R. A. S. Notices, v. 6, p. 149.)

1844 (3) —D. u. Detected by Captain Wilmot at the Cape of Good

Hope, on the 19th December, in Leo. Maclear described it in his letter, dated 3rd January, 1845, to be a splendid object. On the 24th December its tail was about 7° long, and seemingly parallel to the equator. On the 28th he measured the length, and found it to be 8° , "bushy, and slightly curved, (sword-shaped,) towards the North. On the 1st January, (1845,) apparently about 9° in length, the head bright, and the general outline more sharp and clear than the great comet of March."—(A. N., No. 537.) This comet was first detected in Europe, by Colla, at Parma, on the 5th February, 1845, and by Dr C. H. F. Peters, and the writer, at Naples, on the 7th. It appears to have been originally discovered on the 16th December, 1844, in Guiana, but by whom does not seem to be known.—(C. R., v. 20, p. 575; A. N., No. 530.) On the night it was first seen by the writer, and Mr. Graham, it was swallow-tailed. A sketch was made of it at the time, but it has been unfortunately mislaid or lost. It is clear that this fact was not noticed by Dr. Peters, as he described it to be of an oval form, about 3' diameter, faint, and with a sharply-defined nucleus. Petersen obs. it at Altona on the 24th February, the evening of the day on which Dr. Peters' letter was received, and he stated that it was very faint. It was also seen at Thebes, in Upper Egypt, by Professor Lepsius. Encke, under date the 3rd March, remarked, that so far as was then known of it, it appeared to bear a strong resemblance to the comets of 1264 and 1556. On the 3rd January, Mr. Andrew Long, at St. Croix, designated the nucleus a fiery mass, appearing as large as Jupiter in the telescope; and stated that the tail at that date was 5° long.—(A. N., No. 530.) The conjecture of the writer, that this comet might possibly be the same as those of 1264 and 1556, was communicated to Graham immediately after the receipt, at Naples, of Peters' first orbit. Encke wrote again under date the 13th March:—"It is somewhat interesting, because it shows, with the exception of the node, most similarity with the comets of 1264 and 1556, of all those yet seen. If later, no other comet be found, it will be worth while to investigate the old obs., to see if they can be reconciled with these elements, or others similar to them."—(A. N., No. 531.) Many good obs. were made at Auckland, in New Zealand, by Mr Haile.—(A. N., No. 543.) Captain King also obs. it at Port Stephens, in New South Wales. He stated that it was first seen on the 19th December; that on the 8th (supposed January), the length of the tail was 10° , and that on the 4th February the comet was only discernible as a small nebula. Mr. R. Sheppard obs. it at Wellington, in New Zealand, and described the tail to have been fan-shaped, on the 1st January, and said that it was between 8° and 10° long, and about $1^\circ 30'$ broad at the extremity. The nucleus appeared as a star of $2\frac{1}{2}$ mag. to the naked eye.—(A. N., No. 544.) See also

R. A. S., Notices, v. 6, pp. 206-213, and Hind's elements of the comet of 1556, in A. N., Nos. 493 and 634. It is well known that this astronomer still expects the return of the comet 1264 and 1556, and consequently entirely disbelieves any identity of the present comet with them. See also C. R., v. 26, p. 341

1845 (1).—D. by d'Arrest, on the 28th December, 1844, in Cygnus, and then stated to be pretty bright, and well shown in the cometen-sucher. Rümker found it on the 3rd January —(A. N., No. 525.) Resluber said, that on the 28th January, it appeared like an extended nebula, considerably faint, with no conspicuous nucleus, nor visible tail.—(A. N., No. 533) The same astronomer pursued his obs. from the 28th February (? January) until the 9th March, but, on this latter day, could not obs. it owing to its faintness —(A. N., No. 544) In the sitting of the French Academy, on the 13th January, 1845, M. Arago made the following remarks:—"These elements have some analogy with those of the comet of 1793 (2), discovered by Perny, and which President Saron computed in his prison some days before his death. It is known that Burekhardt calculated elliptic elements for this comet, which gave a period of about $12\frac{1}{2}$ years. However, the comet of this year differs too much in P. D. from that of 1793 (2) to admit of the possibility of their identity"—(C. R., v. 20, p. 106.) The present comet was obs. by the writer, and Mr. Graham, on the 26th February, 5th and 7th March.

1845 (2).—D. by de Vico, on the 25th February, in Ursa Major. It was also discovered by Faye on the 6th March. The latter astronomer stated that it had no tail, but that the condensation of the luminous matter in the centre was very distinct.—(A. N., No. 530) Rümker remarked, that in the middle of March it had a sharply-defined nucleus. Petersen confirmed this on the 14th 15th of that month.—(A. N., No. 534.) Clausen's elliptic orbit, which has been omitted, gives a period of 33.067 years; and, on the other hand, Jelinck and Hornstein found an hyperbola!! —(A. N., Nos. 534 and 546) Faye very justly remarked, in the sitting of the French Academy, of the 14th April, (after giving his parabolic elements, and the comparisons with obs.) that he felt authorized to believe that it would not be necessary to have recourse to any other conic section.—(C. R., v. 20, p. 1115.) This comet was also obs. by the writer, and Mr. Graham, at Naples, on the 5th, 7th, 11th, 27th, and 31st March; and on 1st, 2nd, 3rd, 5th, 7th, and 8th April.

1845 (3).—D. by Colla, on 2nd June, in Perseus, and stated by him to have had a brilliant nucleus, with a tail of about 1° in length; and that it was almost visible to the naked eye. He added that the tail was of a conical form, and not exactly opposed to the Sun. Richter also discovered it on the 6th, and said that its brightness was similar to

that of a star of 3rd mag. On the 10th Petersen saw it well with the naked eye. Encke remarked that it was one of the most beautiful comets seen for a long time. Rümker, on the 10th, gave the diameter of the nucleus = 10". Encke added that its appearance reminded him of the comet of 1819 (?). It was seen with the naked eye by several persons between the 6th and 11th June.—(A. N., No 541.) On the 7th and 8th June, Schaub assigned a length of $2\frac{1}{2}^{\circ}$ to the tail. Schubert conjectured a similarity between this comet and that of 1596.—(A. N., No. 542.) Resluber remarked that on the 27th June it was very faint —(A. N., No. 544.) D'Arrest's ellipse gives a period of about 249 or 250 years, and represented the obs. very well—thus confirming the opinion of the identity of this comet with that of 1596 —(A. N., No. 549.)

1845 (4).—Twelfth known appearance of Encke's comet. D. by de Vico, at Rome, and Professor Coffin, at Washington, U. S. A., on the 10th July, in Auriga. De Vico stated that it was very difficult to obs.—(A. N., Nos. 544 and 561.) It was obs. by Walker, at Philadelphia, on the 4th July.—(A. N., No. 561.) There does not appear to have been any orbit computed from the obs. of this year. See note on 1819 (1).

1846 (1).—D. by de Vico, on the 24th January, in Eridanus.—(A. N., No. 554.) The writer suggested, under date the 23rd February, that this comet bore a strong resemblance to that discovered in 1783, by Pigott, but Hind stated that he was tolerably satisfied that this comet was not one of short period —(A. N., No 555.) Santini mentioned in a letter, dated 15th February, that de Vico had described it as having a very distinct nucleus. He added that he himself had obs. it on the 30th 31st January, and that it appeared very faint —(A. N., No 557.) Kaiser mentioned his having seen it on three evenings, towards the end of April, but that it appeared like a small, and barely visible, nebula.—(A. N., No. 565.) Schmidt obs. it between the 18th February and 1st April, and said, that at first, it looked like a pretty bright nebula of about 3' diameter. Afterwards it was not so brilliant, but attained a diameter of about 8' at the end of February.—(A. N., No. 568.) Resluber stated, that on 21st February, the nebulous matter projected from the side opposed to the Sun into a short parabolic tail.—(A. N., No 594.) The elliptic orbit given in the Catalogue, and computed by Jelinck, forces the writer to admit the justice of Hind's remark upon the non-identity of this comet with that of 1783, as the resulting period = 2721 years!!—(O. R., v. 26, p. 281.)

1846 (2).—Fifth known appearance of Gambart's or Biela's comet. D. by de Vico on the 26th November, 1845, in Pegasus. Galle detected it on the 28th.—(A. N., No. 551.) It is only justice to Santini to record

here the following testimony of Hind to his abilities :—"How admirably has the calculation of the perturbations of Biela's comet for 14 years been conducted by Professor Santini."—(A. N., No 552.) Wichmann saw it first on the 18th December, but its extreme faintness prevented any satisfactory obs. He experienced unfavourable weather until the 14th January, but on this night the comet showed itself pretty bright in spite of moonshine and haze, so as to permit of the usual obs. He stated further, that he could not recollect having remarked on this occasion any thing peculiar in its appearance. But, on the following evening, (15th,) he saw in the heliometer, with a magnifying power of 45, two distinctly separated nebulosities of different brilliancy, so that at first he conceived that another comet had accidentally appeared in that part of the heavens. At the same time he saw, by means of obs., that the two nebulosities had similar motion. Since that night the comet seemed steady, and the fainter nebulosity certainly followed the brighter in geocentric motion. On the 26th January, it seemed to him that the distance between the two nebulosities had somewhat increased. He gave measures of position and distance of the two for the 26th and 27th January. The double comet was first seen by Challis on the 23rd January. D'Arrest also frequently obs. the positions and distances of the two comets.—(A. N., No. 554.) Encke wrote on the 25th February, saying, that the Biela comet showed singular phases; that on the 27th and 28th January, the South-following nebulosity was the brightest; and that on the 14th February, the North-preceding was the most brilliant; but that on the 18th, on the contrary, it was again the South-following, and that the same relative brightness continued to the 24th. On the 25th and 26th February, the fainter of the pair preceded, and was North of the brighter. This was obs. by the writer on the 25th, and by Rümker on the 26th.—(A. N., No. 555.) Plantamoor, writing on the 3rd March, stated that he had not seen the new nucleus until the 3rd February. He did not remark on his next obs nights, viz.: 5th, 10th, and 11th, any sensible variation in the relative light of the two nuclei, but on the 12th February, the brightness of the new nucleus had considerably augmented, so much so, that it appeared to him and Bruderer as brilliant as the old one. On the 17th the new nucleus was manifestly larger and more brilliant than the old. On the 18th the latter, although smaller, appeared, nevertheless, to be the brightest. On the 19th the old nucleus seemed not only the brightest, but the largest. They thus relatively stood until the 26th February inclusive—(A. N., No. 556.) Challis obs. the comet and companion on the 20th, 25th, and 27th March. On the last day the smaller comet was so excessively faint, as to be seen with the greatest difficulty.—(A. N., No. 557.) Hackels, of Senftenberg,

stated, that on the 2nd and 4th March, the South-following comet was the brightest.—(A. N., No. 560.) The two comets were seen for the first time at Philadelphia, on the 19th January; but it appears that Lieutenant Maury reported officially on the 15th January the discovery on the 13th of the companion. He seems, therefore, to have been the first discoverer of this most interesting phenomenon.—(See A. N., No. 561.) The extracts taken from the note-book of the Washington Observatory, are the most descriptive that have been given to the public. The comet also appears to have been carefully obs. at Naples.—(A. N., No. 568) Plantamoor wrote as follows on the 18th September:—"As for the secondary comet, I was able to obs. it until the 22nd March, although its light had diminished very rapidly since the month of February. From the 26th February to the 3rd of March, the diminution was very sensible. On the 13th¹ March, with full moon, it was perfectly invisible, whilst the primary nucleus was sufficiently bright to enable the obs. to be taken without difficulty. On the 22nd March, the secondary nucleus had faded to that degree, that it could barely be distinguished from the surface of the sky."—(A. N., No. 584.) The theoretical views contained in this paper, by Plantamoor, although interesting, are omitted as foreign to the object of these notes. For the obs made at the Cape of Good Hope, see A. N., No. 703. Valz obs. nothing remarkable about this comet on the 18th and 20th January. He did not see it again until the 27th, when he was surprised by the two nuclei. D'Arrest and Encke also remarked them at the same date.—(C. R., v. 22, p. 265) Langier too, remarked the interchange of brilliancy between the two nuclei.—(C. R., v. 22, p. 288.) According to the Comptes Rendus, the two nuclei were seen by Wideman at Königsberg, and Challis at Cambridge, as early as the 15th January.—(C. R., v. 22, p. 333.) This information came from Schumacher, so the extract already made from the A. N. must have been incorrect. The following was taken from the registry of the Paris Observatory:—

"The Northern nucleus is the faintest."—(No date).

"The same nucleus is the brightest."—(12th February).

"It is again the faintest"—(19th February).

"From this last date the light of this second nucleus has continually diminished."—(C. R., v. 22, p. 540.) These two comets were obs. at Markree. Plantamoor's elliptic elements give periods of 6.617, and 6.572 years.

1846 (3).—D. by Brorsen, on the 26th February, in Pisces. From the original elements, computed by Petersen, it appeared to Schumacher that this comet bore a resemblance to those of 1532 and 1661. At first it was conjectured that this comet was the same as that discovered by

de Vico (1846 (4).—(A. N., No. 555) Kaiser looked for it, in vain, on the 25th and 26th April —(A. N., No. 565) Argelander found the comet to be very faint on the 21st April, and on the 23rd, and more particularly on the 27th, exceedingly so.—(A. N., No. 571) The Scientific Society of Harlem offered, in 1848, a prize of 150 Dutch goldens for new elements, &c., of this comet.—(A. N., No. 681.) Brünnow took immense trouble in the research of the true orbit of this comet. He agreed in the opinion of its strong resemblance to the comets of 1532 and 1661 —(A. N., Nos. 693, 695, 696) Goujon also obs. this similarity.—(O. R., v. 22, pp. 538-9.) It may not be out of place to state here, that Halley was the first to suspect that the comet of 1661 was the same as that of 1532, and that the period of revolution was 128 or 129 years. Pingré, reverting to preceding apparitions of comets, recognised eleven which he conceived to be of the same comet, and expressed the hope that it would be seen again in 1789 or 1790. Valz attributes to the influence of Jupiter, of course, the change in the period of this comet.—(O. R., v. 25, pp. 611-615.) Hind seems to refer this change to the month of May, 1842 —(O. R., v. 26, p. 604) The period resulting from the first elliptic elements given in the Catalogue is 4 864 years, that from the last is 5 624 years. According to the first theory the comet should have returned to the perihelion early in January of this year (1851), and according to the second, about the middle of last October. Up to this date (31st December, 1851) it does not appear to have been seen.

1846 (4).—D. by de Vico, on the 20th February, in Cetus. He announced it to be small, of pretty bright light, with a slight tail, and a rapid motion in declination towards the North. The motion in right-ascension was Westerly and slow. It was obs. by Petersen and Rümker on the 12th and 15th March. It had, on the 12th, a large nucleus, with considerable nebulosity. The tail could not be well identified —(A. N., No. 555) Schmidt measured the diameter of the nebulosity, on the 21st March, and found it to be = 3'. It had a scarcely perceptible indication of tail. Afterwards, as its lustre diminished, the diameter increased to 5'.—(A. N., No. 568.) Wichmann obs. it on the 25th and 26th March, and it appeared to him like an undefined and faint nebula without nucleus.—(A. N., No. 579.) Goujon remarked that the only comet which seemed to bear any resemblance to the present was that of 1707.—(O. R., v. 22, p. 427.) Hind's elliptic elements give a period of 55.4 years.—(A. N., No. 576, O. R., v. 23, p. 547.) Diense's first set give 72.75 years, (A. N., No. 681,) and his second set, 73 25 years.—(A. N., No. 715.) Peirce's give 94.9 years, (A. N., No. 558,) and H. Breen's, 757 years.—(A. N., No. 564.)

1846 (5). D. by Hind and de Vico, on the 29th July, on the borders

of Cassiopeia and Camelopardalis. Hind described it as a round nebulosity, or very nearly so, with a minute stellar point near the centre. De Vico pronounced it small, all *hair*, and with a nucleus not very distinct—(A. N., No. 572, Supp.) Argelander, after seeing it, on the 12th and 14th August, called it pretty faint, particularly small, but with a brightly shining central point.—(A. N., No. 576.) Wichmann found the comet extremely faint, indeed barely visible, on the 16th, 23rd, and 25th August.—(A. N., No. 579.) De Vico claimed priority in the discovery of this comet, by about two hours and a quarter—(C. R., v. 23, p. 477.)

1846 (6).—D. by C. N. F. Peters, on the 26th June, in Scorpio. It was small, and very faint, without defined nucleus—(A. N., No. 569.) It was also obs. by de Vico, on the 2nd July—(A. N., No. 574.) This comet was searched for in vain at Altona, Berlin, Königsberg, and Hamburg. Dr. Peters' first and second elements, and d'Arrest's first, differ very widely from each other. The comparison of Dr. Peters' second set with the obs. was not satisfactory. D'Arrest then computed elliptic elements which agreed somewhat better with the obs., but still there were, in some instances, very large differences. D'Arrest's elliptic elements give a period of 5804.3 days—(A. N., No. 576.) Dr. Peters also computed an elliptic orbit, given in the Catalogue, which gives a period of 12.8 years, with an uncertainty of one year.—(A. N., No. 657.) The preceding account appears to include all that is known on this comet.

1846 (7).—D. by Brorsen, on the 30th April, in Pegasus. It resembled a pretty large, faint, round, luminous mist, without tail or perceptible nucleus. Its motion was Northerly and Easterly. Wichmann also detected it on the 1st May. It appeared to him to be brighter in the centre. Schumacher noticed some similarity to the comets of 1701 and 1766 (1), and stated that on the 18th July it was within 0.05 of the earth's orbit.—(A. N., No. 558.) Encke could not admit any resemblance to previous comets.—(A. N., No. 562.) Rumker obs. a distinct nucleus when it was near the perihelion.—(A. N., No. 564.) Wichmann stated, that the comet appeared, throughout the entire time of its visibility, as an irregular, large, and bright nebulosity, showing a nucleus with low magnifying power alone—(A. N., No. 567.) Schmidt could obs. no nucleus, properly so called, nor even a considerable concentration of light; at the same time the luminous matter extended fan-like from the Sun in two faintly nebulous arms, inclined to one another at an angle of 70° , forming the coma, from which a part was bent backwards in an Easterly direction, presenting the trace of a tail.—(A. N., No. 568.) Oudemans's ellipse, in the Catalogue, gives a period of 499.87 years.—(A. N., No. 571.) Kaiser obs. it from the 9th May

to the 12th June, both inclusive, at which latter date it was within 23° of the Sun. On the 13th May it was visible to the unassisted eye, and • thus seen well on the 14th. He could barely see the comet on the 15th June.—(A. N., No 572.) Schmidt saw the first distant trace of tail on the 23rd May. On the 24th, this small and faint train extended to above $20'$.—(A. N., No. 594.) Schumacher, in a letter to Arago on the 6th May, called attention to the resemblance between this comet and those of not only 1701 and 1766 (1), but also 1790 (1) and 1798 (query which of the two).—(C. R., v. 22, p. 926.) Wichmann's ellipse in the Catalogue gives a period of 400 years.—(C. R., v 23, p. 106.)

1846 (8).—D. by de Vico, on the 23rd September, in Ursa Major. He stated that it was very similar to 1846 (5), but that the nebulosity was greater.—(C. R., v. 23, p. 687.) There are no other remarks on this comet in the Markree Observatory. Quirling's elliptic elements give a period of 1381 years. See 1847 (5).

1846 (9)?—Before concluding the notes for this year, it is right to mention that Hind notified his discovery of a comet on the 18th October, in Coma Berenices. He obs the object for about an hour and six minutes. He described it as much fainter than 1846 (5). Its altitude was low, and he obs. it in morning twilight. It was never again seen.—(A. N., No 582.)

1847 (1).—D. by Hind, on the 6th February, in Cepheus. The first announcement of this comet is not to be found in the Markree Observatory. Schmidt saw it first on the 13th February, and remarked the appearance of very bright nebulosity towards the centre. On the 19th February it passed so nearly centrally over a star, that he could not say on which side of the star the greatest brilliancy of the comet appeared. Hind first noticed a tail of about $30'$ long on the 9th March, which, within ten days, reached $1^{\circ} 30'$, or $1^{\circ} 40'$; and he suggested the possibility of seeing the comet in day-light on the 30th March.—(A. N., No. 954.) Schmidt saw it with the naked eye from the commencement of March, at first faint like a star of the 6th mag. He could not, however, then see the tail or its nebulous appendage. With a low power the nucleus was visible as a star, but this was lost with a power of 300. He described the tail as about $2'$ wide, and on the 17th March fan-shaped. The coma appeared to him to be spherical, its diameter being between $4'$ and $6'$. He computed that the comet would approach (apparently) very near to the edge of the Sun on the 29th March.—(A. N., No. 596.) Hind wrote as follows on the 13th April:—"The comet was obs. here, (Regent's Park,) at noon, on March 30th. It was first perceived at 11, A.M., with a power of 40 on our large refractor, the eye being protected from the intense glare by a light green glass. The nucleus of the comet was round, or nearly

so, beautifully defined and planetary. Two short rays of light formed a divided tail, not more than 40" in length. At times I felt certain that the nucleus twinkled like a fixed star."—(A. N., No. 597.) R-s-lhuber obs. it from the 23rd February to the 24th March, both inclusive. The comet appeared to him at first as a nebulosity of 3' diameter, with a faint nucleus only discernible at intervals. On the 28th February, he obs. it in pretty bright moonlight, as also on the 2nd, 4th, and 5th March. On the 10th March, after the cessation of moonlight, the nucleus of the comet was clearly seen. On the 12th he perceived a tail in a very pure sky, which was somewhat broad at its junction with the nebulosity, but stretched forth more narrowly, and reached to almost 30'. On the 14th and following days, the comet continually increased in brilliancy, size, and length of tail, until it was seen by the naked eye. On the 15th the tail appeared to be 2° long in the Cometen-sucher. On the 17th it was seen by the unassisted eye. On the morning of the 21st it was so bright, that he obs. it half an hour before sunrise. On the 24th he again obs. it within half an hour of sunset.—(A. N., No. 646.) Yvon Villarceau's ellipse, given in the Catalogue, assigns to this comet a period of 552 years.—(C. R., v. 24, p. 449.) It was also obs. at Cambridge, Mass, U. S. A.—(A. N., No. 598.) Mr. Graham, of the Markree Observatory, was the first to announce the true form of the orbit of this comet, and proved that it would pass (apparently) near to the Sun.—(C. R., v. 24, p. 499.) Valz was unable to perceive it near the Sun, on the 31st March.—(C. R., v. 24, p. 639.) The same fate attended a similar effort made on each of two days by the writer; but being absent from home, he had only a small telescope with which to make the attempt. The period which Graham's ellipse gives=11991 years, upon which he called to mind the remark of Delambre—"If the parabola suffices not for ellipses of such length, it never will suffice."—(C. R., v. 24, p. 900.) In the sitting of the French Academy, on the 19th April, 1847, M. Arago made some remarks on the phases which the nucleus of the comet must have exhibited, on the assumption of its being a solid mass; and he requested M. Faye to communicate with Mr. Hind on the subject. Hind wrote thus in reply:—"The passage of the comet near the Sun, on the 30th March, appears to have attracted the attention of observers in many astronomical establishments of Europe, but the state of the atmosphere was not favourable to their researches." It was during a short clearance that Hind at last discovered the comet near the Sun. He added—"My deep conviction is, that an appearance of this nature (phase) could not have escaped my attention. About 1^h 54^m, P. M., at the time that the comet appeared to be best defined, I certainly suspected a slight alteration in the circular form of the nucleus, but at

11^h 10^m, A.M., I had examined the comet with the same eye-piece, the alculated phase being then greater, it should have been then more appreciable, and, nevertheless, I saw nothing of the kind—the nucleus appeared perfectly round, and the edge perfectly defined.”—(C. R., v. 24, p. 1104.)

1847 (2)—D. by Colla, on the 7th May, in Leo Minor. It was very faint, having the appearance of a small nebulosity nearly circular, and with some trace occasionally of a scintillating point in the central part. On the 13th and 14th it was extremely faint as seen at Paris. Its light had somewhat increased on the 15th.—(C. R., v. 24, pp. 879–880.) Littrow stated, that notwithstanding the smallness of the comet, he was nearly able to affirm that it showed no regularly spherical mass, but an oblong figure. He likewise observed, in a letter dated the 10th September, that the comet was remarkable for an almost continued change of light—a change so distinct, that, notwithstanding the comet's faintness, a very correct obs. could be made at the time of the change, a circumstance which often occurred.—(C. R., v. 25, p. 429.) Challis obs. it up to the 8th December.—(C. R., v. 25, p. 973.) Lassell to the 30th December.—(C. R., v. 26, p. 109.)

1847 (3).—D. by Schweizer, on the 31st August, in Cassiopeia. He merely remarked that it was faint.—(A. N., No. 612.) Schmidt obs. it on the 18th and 19th September. He called it very faint, and of about 3' diameter.—(A. N., No. 617.) O. Struve found it on the 6th September. He described it also as being faint, and with no discernible centre, so that there was great uncertainty in the obs. Döllén's elliptic elements yield a period of 228 years.—(A. N., No. 645.) Schweizer's ellipse gives for a revolution 13918 years. Will not a parabola suffice here? This comet does not seem to have been noticed in C. R.

1847 (4).—D. by Mauvais, on the 4th July, on the borders of Cepheus and Ursa Minor. His description of it was, that it had a pretty distinct nucleus surrounded by an oblong nebulosity, which seemed to stretch out a little in the form of a tail. The diameter of the nebulosity was from 4' to 5'.—(A. N., No. 605.) Schmidt gave the diameter on the 15th July = 5' 12", and the length of the fan-shaped tail = 8'; but on the following day he could with no certainty recognise the trace of tail. On the 21st the diameter of coma = 2' 36".—(A. N., No. 607.) This comet was also discovered on the 14th July, by Mr. G. P. Bond, at Cambridge, U. S. A.—(A. N., No. 611.) Schmidt, writing on the 21st August, stated, that since the beginning of the month he had seen an evident tail of from 8' to 10' in length.—(A. N., No. 612.) The same astronomer said that the comet had become very much fainter at the end of August, but that it could be pretty well obs. to the middle of September. He saw the last trace of

tail on the 12th of that month.—(A. N., No. 617.) He obs. it up to 14th December inclusive.—(A. N., No. 624.) Schaub found it again on the 4th February, 1848, and obs. it on that and the following day.—(A. N., No. 631.) Lassell obs. it to the 3rd April, 1848, inclusive. It appeared at this time to have a very minute stellar nucleus.—(A. N., No. 635, R. A. S. Notices, v. 8, p. 143.) Challis obs. it to the 6th April, inclusive.—(A. N., No. 637.) Lattrow anticipated the long duration of the visibility of this comet from a certain analogy to that discovered by Colla, (1847) (2).—(C. R., v. 26, p. 279.) He also remarked the same quick changes of light in this comet, as in that of Colla.—(C. R., v. 26, p. 414.) Challis, at the period of his last obs., could see no appearance of stellar nucleus, but only an exceedingly faint nebosity of about the same apparent diameter as Mars.—(C. R., v. 26, p. 462.) Bond reported a scintillating appearance.—(C. R., v. 26, p. 485.)

1847 (5)—D by Brorsen, on the 20th July, in Triangula. He merely stated that it was faint. It was obs. on the following day by Petersen and Rumker, and was described to be very faint, of undefinable shape, and without visible nucleus.—(A. N., No. 606.) Schmidt, from the 11th to the 18th August, found the comet very bright, and exceeding the others in splendour. He perceived the first trace of a tail on the 12th. Quirling and Niebour's elliptic elements give a period of 125.4 years.—(A. N., No. 612.) D'Arrest's elliptic elements assign a period of 75 years.—(A. N., No. 662.) Faye, from his first provisional orbit, conceived some analogy between this comet and that of 1686, the elements of which were computed by Halley from rather uncertain data.—(C. R., v. 25, p. 266.) In the sitting of the French Academy of the 26th August, Faye presented elliptic elements which, he remarked, did not favour his previous hypothesis of an identity of this comet with that of 1686.—(C. R., v. 25, p. 288.) An interesting paper, by Valz, was read at the French Academy, on the 11th October, entitled, "Notice on a common origin attributed to two new comets." He commenced by observing upon the singular separation into two parts of the comet of 6.75 years' period (Biela or Gambart's). He supposed that such a separation might have produced the two comets 1846 (8) and the present; and then proceeded to say, that from the first obs. of the present comet, he was struck with the remark, that these comets followed nearly the same path—the present one preceding the other by only 11° , which corresponded to an interval of but seven days; and that on the 26th February and 5th March, their declinations were the same, and the difference of their right ascensions was only 2° . On the 15th and 30th March, when the declinations were identical, the right ascensions presented a difference of only $20'$ reducible to $14'$ of an arc

of a great circle. "It is true," he said, "that the *real* motions of these bodies may differ mutually, much more than their apparent," but after witnessing with his own eye the fact of the separation of the comet 1846 (2), his thoughts were naturally directed to this new phenomenon, and he was led to the examination of a subject of interest sufficiently great. Now it resulted from the elements of the two comets, that their orbits were very near meeting, and that but slight changes would suffice to cause their intersection. In fact, 15° before the ascending node of the one, and 30° before that of the other, the radii vectores, in the direction common to both, differed only three hundredths, so that all that was requisite to derange the intersection, was a slight change in the longer of the two periods, found to be 95 years by Bond, 138 years by the Roman astronomers. . . . Their P. D.'s are within 0.01 from one another, and their distances from node to perihelion the same.—(C. R., v. 25, pp. 495, 6)

1847 (6).—D. by Miss Maria Mitchell, on the 1st October. It was seen at Rome on the 3rd, was obs. at Cambridge, U. S. A., on the 7th, and on the same day seen with the naked eye by the Rev. Mr. Dawes, at Cranbrook. This gentleman described it as a hazy star of the 5th mag. near ω Draconis. On the 11th it had the light of a star of the 4th mag. near η Herculis. The nebulosity appeared in the telescope to extend over $30'$, was nearly round, and much condensed in the centre, but without stellar nucleus. A star of the 10th mag. was distinctly seen through the exact centre of the comet.—(R. A. S. Notices, v. 8, p. 9.) Madame Runkler also discovered this comet on the 11th October.—(A. N., No. 616.) From Oudemans's first elements Kaiser deduced some similarity between this comet and those of 1842 (2), 1742, and 1301 (2).—(A. N., No. 617.) Littrow stated that on the 12th October it was visible with difficulty to the naked eye as a star of 3rd 4th mag., and on the same night he obs. the extension of the coma to about $30'$ diameter.—(A. N., No. 620; C. R., v. 25, p. 631.) Schmidt saw it up to the 15th December, but it was very small and faint.—(A. N., No. 624.) Littrow obs. it to the 19th December.—(A. N., No. 625.) Schaub insisted on the resemblance of many of the elements of this comet to those of the comet of 240.—(C. R., v. 25 p. 757.)

1848 (1).—D. by Petersen, on the 7th August, in Auriga. The comet was small, pretty well defined, bright, and good to obs.—(R. A. S. Notices, v. 7, p. 207.) Hind stated, that on the 19th August the diameter was about $1' 30''$, with a very strong condensation of light, somewhat eccentrically placed, on the side next the Sun.—(A. N., No. 647.) This comet was seen but for a short time, and obs. in few places. (A. N., No. 691.)

1848 (2).—Thirteenth known appearance of Encke's comet. D. by

Hind on the 13th September. He called it the faintest object that could be obs. in a dark field with his telescope of seven inches aperture.—(A. N., No. 648) Wichmann stated, that in reference to the appearance of the comet, it struck him as remarkable that the brightest and densest part of the nebulosity, which would be taken for the nucleus from its appearance, was not in the centre, but lay in the part turned away from the Sun.—(A. N., No 660.) The comet was very well obs. at this apparition, and some very interesting facts were noticed by Mr. G. P. Bond of Cambridge, U. S. A., confirming the preceding remarks, and including others of not inferior interest, but for the detail of which the reader must be referred to A. N., No. 723 Colla remarked traces of scintillation throughout the entire mass of nebulosity. See 1819 (1.)

1849 (1)—D. by Petersen, on the 26th October, 1848, in Draco He said that it was pretty large, with a distinct nucleus.—(A. N., No 652.) Hind stated, in a letter dated the 24th November, that the comet did not appear round in his telescope, but having a short fan-like tail about 8' in length. He also added that there was no decided nucleus, but a sufficient condensation of the nebulous matter to render the obs. in an illuminated field easy and certain.—(A. N., No. 657.) Hartnup perceived a stellar nucleus on favourable occasions —(A. N., No. 664) Reslhuber obs. with certainty for the first time on the 12th December, a short faint tail extending to from 12' to 15'.—(A. N., No. 680.) It was not seen in America until the 25th November, by Mr. G. P. Bond.—(C. R., v. 27, p 627) At this date the comet showed a finely marked nucleus with a tail of 15' or 20'. On the 18th December the tail was 2° in length, and there were traces of a secondary tail at an angle of 10° or 20° with the principal one. On the 19th December the breadth of the tail in its brightest part, being about 20' from the nucleus, was only about 1'.—(A. N., No 723) This comet was visible to nearly the end of January, 1849.

1849 (2).—D. by Goujon on the 15th April, in Cratera. He remarked that its nucleus shone with a pretty vivid light, and that it was surrounded by a broad circular nebulosity without any trace of tail—(A. N., No. 671., C. R., v. 28, p 513.) Hartnup saw this comet on the 23rd June, like a faint, nebulous star The nucleus was decidedly stellar, and about equal to a star of 12th or 13th mag.—(A. N., No. 681.) See R. A. S. Notices, v. 9, pp. 161 and 196. Plantamoor found it to be very faint on the 27th 28th July—(A. N., No. 690) Schmidt remarked at almost every obs. a trace of a short tail in the direction opposed to the Sun.—(A. N., No. 691.) Lapunow obs. a changing brilliancy on the 16th June The nucleus reached in light that of a star of 10th mag.—(A. N., No 692.) Reslhuber said that this

comet appeared at first like an extended nebulosity of from 5' to 6' diameter, and had a nucleus somewhat eccentrically placed. In the middle of May he saw traces of a broad but short tail. In the middle of June the comet was much fainter.—(A. N., No 694) It is scarcely worth notice that Valz had some slight impression of an analogy between this comet and that obs at Rome, in 1684, γ Bianchini.—(C R., v. 28, p. 603) This comet and its tail was seen at Markree, and considered to be brighter than the following, 1849 (3), but the extent of its nebulosity was very inferior.—(R. A. S. Notices, v. 9, p 225)

1849 (3)—D. by Schweizer, on the 11th April, in Corona Borealis, or on the borders of that constellation and Bootes. The account given in the R. A. S. Notices is, that Schweizer saw it in conjunction with χ Bootis, and about 1° South of that star.—(v. 9, p. 162.) The relation of the discovery in A. N. is from Schweizer himself, and states that he found it in the vicinity of β Corona Borealis, that it had the same right ascension as χ Bootis, and that its declination was 1° South of the latter star.—(No. 671.) Schumacher expressed to our Astronomer Royal his suspicions that there was some mistake as to the star referred to by Schweizer. Professor Bond discovered it a few hours later than Schweizer, and Graham also, at the Markree Observatory, on the 14th. The comet had a strong, star-like, central condensation, an extensive coma, but no tail. It has been supposed to be the comet of 1748 (2), the elements of which were computed by Bessel from three imperfect obs. of Klinkenberg.—(R. A. S. Notices, v. 9, p. 162.) On the 16th April a greater condensation of the mass of the comet was remarked at Markree. The nucleus was very distinct, the coma faint. On the 17th the comet was considerably brighter, the coma much extended, almost filling the field of the large telescope, but was very faint. The nucleus again very distinct.—(R. A. S. Notices, v. 9, p. 223.) Luther admitted the resemblance to the comet 1748 (2), and appeared to advocate a period of 101 years, in preference to a shorter one, because the middle obs. used in the computations of his elements agreed within 4" of the parabolic curve. Professor Peirce also obs. the similarity to the 1748 comet. Gould, from his elements, found the minimum distance of the comet from the earth = 0.175, and predicted therefore a rapid increase in its brightness.—(A. N., No. 671) Schweizer produced hyperbolic elements, so that O. Struve remarked that there would be little probability of proving the identity with the comet 1748 (2), unless the Cape obs. should give some assistance, and show that the apparent hyperbolic form of the orbit proceeded from the perturbations caused by the earth.—(A. N., No 676) D'Arrest's elliptic orbit gave a period of 8375 years, upon which he said that it

might be assumed to be certain that the apparitions of 1748 and 1849 were of different heavenly bodies—(A. N., No. 704.)

1849 (4)¹—D. by the Rev. J. Jenkins, on the 28th November, at sea. "On the 28th November, at 7 $\frac{1}{2}$, P. M., (being then in about 10° South latitude, and 30° West longitude,) we saw a comet to the Westward, nearly in the track of the Sun, about 14° above the horizon, as measured with the quadrant. The nucleus very distinct, about as large in appearance as Mars, the tail curved and pointed towards the South (S.W.), quite bright, and nearly a degree in length, as seen by the naked eye, but much larger when viewed with the glass. It was seen by all the crew for about twenty minutes, when a cloud obscured it and it was seen no more." "Mr. Curley suggests the probable identity of this comet with the great comet of 1556, to which Mr. Hind has drawn attention." Mr. Hind, alluding to Mr. Curley's letter, said, "I think it is *quite possible* that the comet seen by the Rev. J. Jenkins, on November 28th, 1849, may have been the great one expected about that time. My own opinion, however, though I must admit the possibility of identity, is, that the object obs. was not the expected comet." He then gave his reasons. See R. A. S. Notices, v. 10, p. 122. Captain Horner, the master of the vessel in which Mr. Jenkins sailed, gave, subsequently, an account of the comet, differing materially from the first, and negating the likelihood of any identity with the looked-for return of that of 1556.—(R. A. S. Notices, v. 10, pp. 192-3) The introduction of any notice of this presumed comet is an exception to the rule laid down, of confining this work to those comets whose orbits have been computed, but it was thought better not to exclude it, as it has been deemed possible that it was an apparition of the comet of 1556. It seems strange, that in the latitude in which it was seen, it should never have shown itself again.

1850 (1).—D. by Petersen, on the 1st May, in Draco, and merely described as faint.—(A. N., No. 715.) Same statement by Villarceau, May 10.—(C. R., v. 30, p. 780.) Hind, writing on the 23rd May, stated that his telescope exhibited a fine point of light in the centre of the nebosity.—(A. N., No. 718) Fuss could only see it in an unilluminated field, on the 14th May. Petersen obs. a small bright point in the nebosity, like a very faint star.—(A. N., No. 723) Hind obs. that the comet of 1748 (2), appeared to be the only one with elements at all resembling those of this comet, but that even in this case the P. D. and L. of node were a good deal different.—(A. N., No. 724) On the 11th June Galle found the comet brighter, and with a pretty well defined central point. On the 1st July the central point was well shown. On the 14th July it was visible to the naked eye as a nebulous star of 5th 6th mag. With a low magnifying power the nucleus appeared like a

bright stellar point, and opposed to the Sun there was a faint tail-like extension. Secchi wrote to say that on the 27th June the comet was faint, and showed no distinct nucleus nor tail, but that on the evening of the 2nd July it was visible to the naked eye, and had a fine but very narrow train about 2° in length. On the 3rd its form was changed, being in the shape of a fan, and bifid. A nucleus began to show itself, but was ill-defined.—(A. N., No. 726) Lassell stated that on the 14th the nucleus of the comet did not appear stellar, but more like a bright planetary Nebula surrounded by haze. Still it seemed to increase gradually in brightness towards the centre. No positive tail could be seen, though the comet appeared to throw out two rays, one preceding, and the other at an angle of about 45° North preceding. Reviewing the comet during the latter part of June, he received an impression of a starlike appearance almost close to the nucleus, which was North preceding. The physical aspect of the comet was often very unsatisfactory from real or apparent changes, which seemed frequently, and sometimes rapidly to occur, such as to convey the idea of passing clouds. The star-like appearance was not so positive or constant as to satisfy him that it was really another nucleus. On the 16th the bright point near the nucleus was occasionally but not constantly seen. On the 18th the same physical appearances as on the 14th were noticed, especially the stellar point, North preceding the nucleus, which he thought must be a reality, though short of absolute verification. On the 19th again the same Carrington found the diameter of the coma on the 29th June, $=2' 6'' 3$.—(A. N., No. 727.) Lieutenant Maury, of Washington National Observatory, wrote as follows:—"I obs. the sort of triangular assemblage of nuclei to Petersen's comet. The appearance was not distinct enough to make any more than an *impression*, and that so faint withal as to leave me in doubt as to whether the appearance was real or imaginary." In the notes appended to the Washington obs. there are to be found,—“June 11th.—There seems a nucleus, like a cluster of stars of the 11th mag. The central part of the comet like white star dust. June 19th.—Central part of comet like a cluster of small stars, five or six of the 12th 13th mag. June 30th.—The comet more diffused than formerly—less appearance of nucleus. July 14th.—The appearance heretofore noticed like a stellar group, not observable now.” Reslhuber measured the diameter of coma on the 3rd July, and found it to be $=5'$.—(A. N., No. 737) See Schmidt in A. N., No. 736. In the humble judgment of the writer there is less resemblance between this comet and 1748 (2), than between the latter and 1849 (3) Petersen and R. Schumacher's elements were derived from obs. of 4th May, 6th June, and 9th July. “It has been impossible to represent the middle obs. closer than to $7''$ in L and E, but the difference is too small

to warrant the conclusion that this is a sign of ellipticity."—(R. A. S. Notices, v. 10, p. 167.) Sontag's elements have resulted from a complete examination of all the obs.

1850 (2).—D. by Bond, on the 29th August, in *Camelopardalis*. Also by Brorsen, on the 5th September, who called it pretty bright, but faint at its limits, and without visible nucleus.—(A. N., No. 732.) Again it was independently discovered by Mauvais at Paris, and Robertson at Markree, on the night of the 9th September. Mauvais described it to be a white nebulosity pretty similar in appearance throughout, of 2' to 3' diameter, and without bright centre or tail. Graham called it a very diffused and faint nebulosity, almost filling the field of the twenty-five feet telescope. No nucleus could be detected.—(A. N., No. 734.) Valz obs. it up to the 13th October.—(A. N., No. 738.) Carrington saw this comet best on the 17th September. He thought it a little elongated in the North-following direction. On the 15th September it appeared to Reslhuber as a pretty extended, pale, round Nebula without visible nucleus or tail.—(A. N., No. 741.) The node of Rümker's orbit is given as $20^{\circ} 1' 31''$ in R. A. S. Notices, being evidently a misprint for $206^{\circ} 1' 31''$. The orbits by Vogel and Reslhuber are the most trustworthy. The rest are derived from arcs, extending only over eight or ten days, so far as can be ascertained.

1851 (1).—The first re-appearance of Faye's comet, 1843 (3). D. by Challis, on the 28th November, 1850, with the Northumberland equatorial, and obs. by him on that and the following night; also on the 6th, 7th, and 25th December; again on the 5th, 22nd, 24th, 27th January, 6th and 8th February (printed 86 February), and 4th March, 1851. On the 29th November, 1850, Challis considered it to have been rather more brilliant. On the 6th and 7th December extremely faint; in fact barely perceptible. On 5th July, 1851, extremely faint. On 22nd an appearance now and then of a nucleus. The 24th scarcely visible; and on the 27th more brilliant than on any of the preceding occasions, and easily observable. The coma showed a faint elongation in the South-following direction. February 6th, at times the comet appeared to have a scintillating nucleus. February 8th, scarcely perceptible. March 4th, the last degree of faintness.—(C. R., v. 32, pp. 812-3.) In the sitting of the French Academy of the 2nd February, 1852, a communication was made from M. Otto Struve, by M. Leverrier, in which he said—"Now that the comet has disappeared again, nine months since, we perceive that, excepting our measures, the entire collection of obs. obtained this year consist in only twelve positions—partly very uncertain, according to the judgment of Mr. Challis himself—determined by the Northumberland equatorial of the Cambridge Observatory, in England, and two obs. made in America by Mr. Bond,

at the beginning of January. Although the number of obs. that I have found it possible to make amount to only ten, we see that they nearly double the data serviceable for the correction of the elements. For this reason, I presume to attribute to them a certain degree of importance, and that still more, in that all the obs are of a pretty high degree of exactness." M. O. Struve adds, in notes, that "on the 24th January the apparent diameter of the comet was 25", that on the 1st February the intensity of the light had increased. On the 7th the comet was extremely faint, on account of moonlight, that on the 21st February its apparent diameter was 20", that on the 2nd March it was very visible, and towards the end of the obs., on the 4th March, it was very faint."—(C R., v. 34, pp 179-182.) M. Leverrier's labours on this comet were crowned with the success which has invariably attended his investigations. In the A. N., No. 541, he published prospective elements, founded on the obs. made in 1843 and 1844. By the introduction of an indeterminate quantity μ'' he was able to represent the change which the elements would undergo in consequence of the alteration which would probably be found necessary in the mean motion of the comet. It resulted from the investigation that μ'' could not exceed the limits of $+\frac{1}{3}-\frac{1}{3}$. The orbit stood thus.—

1851, April 3 5031, M. T. Paris.

Mean diurnal motion,	475"1849 + μ''
Mean anomaly,	0° 0' 00" + 2769 68 μ
Angle of eccentricity,	33 42 43 36 — 82.60 μ''
L. P,	49 42 40.09 — 256 97 μ''
I,	11 21 39.70 — 2 97 μ''
L. Node,	209 30 35 01 + 109 12 μ''

The L.'s are reckoned from the mean equinox of 1st January, 1851. Proceeding upon these data, Mr. Stratford published, on the 19th November, 1850, a triple ephemeris, calculated on the hypotheses $\mu'' = -\frac{1}{3}$, $\mu'' = 0$, $\mu'' = +\frac{1}{3}$. It was by the aid of this ephemeris that Challis discovered the comet. The comparison of his first two obs. with this ephemeris gave the mean value of the factor μ'' , as determined by the right ascensions $= +0''.263$, and by the declinations $= +0''.290$, the mean value being $= +0''.277$. The ephemeris was, however, computed on the supposition of an invariable orbit, and consequently the places required corrections up to 1851, April 3.4966, G. M. T, which, as the time of P. P. on the supposition that $\mu'' = 0$ was the epoch chosen by Leverrier. Taking these corrections into account, he found from the obs. of 28th and 29th November, 1850, that by the right ascensions $\mu'' = +0''.2895$, by the declinations $= +0'' 2946$, and hence the mean value $\mu'' = +0''.2903$.—(R. A. S. Notices, v. 11, p 38; C. R., v. 31, p. 792; A. N., No. 541.) The two obs. made at Cambridge, U. S. A., were

on the 1st and 4th January, 1851. The comet was described by Bond as a very faint object in the 23 feet refractor. He said that it appeared, when best seen, slightly elongated in the direction of the Sun.—(A. N., No. 748; C. R., v. 32, p. 305) Adopting the value of μ'' as given above, the values result for the elements of the orbit which are given in the Catalogue, and which may be regarded as founded on the obs. made in 1843, 1844, and the two by Challis in November, 1850.

1851 (2).—D. by d'Arrest, on the night of the 27th June, in Pisces. It was very faint. Upon this occasion a rough obs. was all that could be obtained on account of the twilight. On the 29th he made as satisfactory an obs. as the extreme faintness of the object would permit. It was obs. at Cambridge on the 7th and 21st August, and the 22nd September. Challis remarked, that on the last-mentioned day, the comet was faint, and so much diffused that it was difficult to fix on the brightest point—(A. N., No. 779.) It was also obs. at Durham, on the 24th and 30th August, and on the 1st and 6th September. As seen there, it exhibited no nucleus. Attempts to obtain its position, after the 6th, were unsuccessful. The period deduced by the discoverer, from his own elements, given in the Catalogue, is about $6\frac{1}{2}$ years. The results of the periodic time, derived from the different computers, are remarkably discordant, as may be seen from comparing the following: Villarceau's first = 2921 days.—(R. A. S. Notices, v. 12, p. 18.) Vogel's = 2709 days; Pogson's 2001; and d'Arrest's first, = 2353 days.—(R. A. S. Notices, v. 11, p. 220) Vogel's elements were deduced from obs. made at Berlin, on the 2nd and 23rd July, and 4th August; Pogson's, from the obs., at Leipsic, by d'Arrest, on the 29th June; and two, made at Bonn, on the 6th and 24th July. Villarceau's first, from five obs. made at Leipsic and Berlin between the 29th June and 6th July, and two obs. made at Paris on 27th July and 3rd August. The last, he said, was rather doubtful, and he employed it only on account of the impossibility of getting others without too great delay. Valz was of opinion that this comet and that of 1678 were identical.—(C. R., v. 33, p. 155) Villarceau also had made the remark suggested to the French Academy by Valz, but he thought that the perturbations, during the interval, should be computed before pronouncing their identity. D'Arrest likewise perceived the similarity between the orbit of this comet and that of 1678, excepting only the I., but he attached little weight to this coincidence, in consequence of Leverrier and Brunnow having assigned to the comet of 1678 an identity with that of de Vico (1844 (1). D'Arrest's first approximation to the orbit was a parabola from his own obs. of 29th June, and 2nd and 6th July—(A. N., No. 765.) Dr. Luther published obs. made on this comet on the 1st, 2nd, 5th, 23rd, and 28th July, and on the 2nd

and 4th August, but made no remark on its physical appearance.—(A. N., Nos. 768–771.) Argelander obs. it from the 27th July to the 7th August.—(A. N., No. 771) Wichmann stated, that on the 21st September, in a *vapourish* sky, the comet was very faint, on the 22nd and 27th, in a very clear sky, it was still faint, and on the 30th, in pretty clear weather, it was extremely faint. He added, that throughout his obs the appearance of any nucleus was very doubtful.—(A. N., No. 778.) Reslhuber stated, that on the 28th July, it was very pale, round, of tolerable extent, without nucleus or tail; on the 20th August, particularly faint; and on the 1st October, scarcely to be recognised.—(A. N., No. 792.) The last orbit, by d'Arrest, viz, his third; and the last, by Villarcœu, viz, his second, may be assumed to be definitive. The resulting periods are, respectively, 1912 and 1911 days.

1851 (3).—D. by Brorsen, on the night of the 1st August, in Canes Venatici. Although small, he called it bright. His first obs. was very difficult in consequence of interruptions by clouds, and the low altitude of the comet. On the 4th August he obs. it at Altona, but it was seen with difficulty, owing again to unfavourable weather, and he expressed his distrust of the obs.—(A. N., No. 770.) Very careful obs. were made at Berlin on the 4th, 5th, and 6th August. On the 10th, Argelander could not find it, but there was strong moonlight and a hazy atmosphere. On the two following days, the latter of which was that of the full moon, Plantamoor obs. it at Geneva. Of course it was very faint.—(A. N., No. 771.) It was obs. by Trittenero, at Padua, from the 16th to the 27th August. He made no remark on its physical peculiarities.—(A. N., No. 774.) Rumker obs. it, at Ham-burgh, from the 4th August to the 22nd September. Hartnup, at Liverpool, from the 13th August to the 6th September. Carrington, at Durham, from the 19th August to the 21st September. He said—“No nucleus traceable, the comet has gradually been becoming fainter, it was a very difficult object on the 21st September. I have seen it twice since that date, but have been unable to procure any obs.” It was obs. at Cambridge on the 11th, 18th, and 28th August.—(R. A. S. Notices, v. 11, p. 222.) Mr. Boreham obs. it on the 13th, 14th, 18th, 21st, and 28th August, at Haverhill.—(R. A. S. Notices, v. 12, p. 18.) The period resulting from Brorsen's ellipse = 5544 years. Reslhuber found it on the 11th August in full moonlight. It was faint in so bright a sky, and difficult to obs. In the absence of the moon, on the 20th, it was somewhat brighter, but still very faint, and showed a small nucleus. On the 22nd September, he could only perceive a mere trace of it.—(A. N., No. 792.)

1851 (4).—D. by Brorsen, on the 22nd October, in Canes Venatici. He described it as having a brilliant nucleus, and a tail equally brilliant,

and more than one degree in length. Its appearance resembled Hind's comet, 1847 (1). On the night of the discovery, Brorsen added—"The comet has two tails, the first, as in Bessel's sketch, is directed towards the Sun."—(L'Institut. 5th November, 1851.) Mr. Hartnup remarked that it was very faint on the 17th November. "The nucleus on the 12th was steadily seen, generally as a very minute star, but occasionally, for intervals of a few seconds, it appeared quite bright, and had a rather large planetary disc. The tail was about 40' long, and about 2' broad in the widest part. It was directed from the Sun, and was formed by the curvilinear rays of light proceeding from the nucleus, and meeting at the end of the tail, which terminated in a point."—(R. A. S. Notices, v. 12, p. 2; A. N., No. 793) Brorsen, on his obs. of 23rd October, remarked, that the shorter tail turned towards the Sun, appeared again very clearly, and formed, together with the larger averted tail at both ends, where the tails gradually disappeared, the figure of a single, blunted, or obtuse-angular cone, of which the broader base formed part of the larger tail. Therein the nucleus was situated.—(A. N., No. 782.)

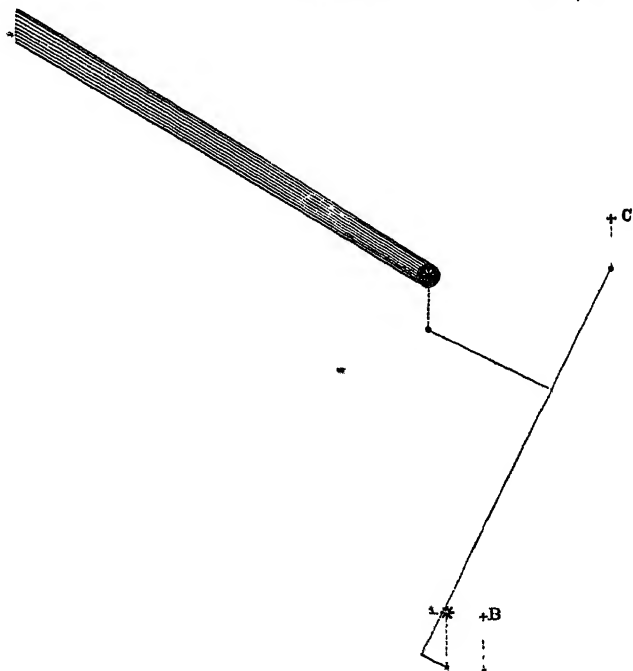
APPENDIX,

ADDRESSED TO AMATEURS.

Supposing that you were to discover a comet when you had no micrometrical apparatus by you, in any place of which you know the latitude and longitude pretty correctly, and supposing that you have not even a single spider's line by which to ascertain the Equatorial parallel, proceed thus:—Map the stars in the field with the comet as accurately as possible, by remarking their angular configuration, and by affixing to each a letter or number to show the relative apparent magnitudes. *Last of all*, mark the comet's place, noting the time with the best watch you have. Should there be no well-known star in the field, observe as nearly as you can the point to which the telescope is directed with reference to one or two of the nearest well-known stars. This will serve to identify those in your Diagram subsequently at any Observatory, or by good maps and catalogues. A line should also be drawn through your Diagram to indicate the parallel to the equator, which you can get approximately by passage of a star across diameter of field. Having obtained the *true* places of some or all of your stars, you find the comet's *true* place by following the process shown in the following example.

Day Eye-Piece of Harris's Telescope,
M T. = 7h. 53m 24s.

March, 21st.



On the 21st of March, 1843, with a small portable telescope, by Harris, which is unprovided with a micrometer eye-piece, I mapped the relative positions of the great comet and three stars in field with it, of which map the preceding Diagram is a correct transcript. These stars I have distinguished by the letters A, B, C, in the order of their apparent magnitudes. The largest star, (A) I afterwards found to be ζ Eridani, and the true places of it and the other two were, at the time of observation—

	$R =$	^{h.}	^{m.}	^{s.}	[']	["]	$\delta =$	[°]	[']	["]
A		3	8	13 45	= 47	3 22		9	24	22
B		3	7	54 48	= 46	58 37		9	21	23
C		3	8	27 05	= 47	6 46		8	30	27

The comet having been very low at the time of observation, it was judged necessary to correct the observed places for refraction. The true altitudes of A and C, at the time of observation, were $7^{\circ} 35'$ and $8^{\circ} 15'$ respectively. Let us give here the calculation for A :—

Sid time of observation,	^{h.}	^{m.}	^{s.}
	7	48	1.4
A's right ascension,	3	8	13.4
Hour angle,	4	39	48.0 = 69 57
9 8392719 = sin ,	Latitude,	43	41
			cos. = 9 5350915
			cot. = 0 0199674
0 0263291 = sect ,	(subt. ,)	19	45
A's N. Polar distance,		99	24
			tan = 9 5550589
9 2544532 = cos.		79	39
9.1200542 = sin	true altitude,	7°	35'

Having thus obtained the true altitudes, the mean refractions for A and C, found from the tables, are $6' 49''$ and $6' 19''$ respectively. To find the magnitudes of these quantities on the same scale on which the map is drawn, it is necessary to calculate the true distance of A and C in seconds, and compare it with the measured distance on the map—

A's R	[°]	[']	["]	δ	[°]	[']	["]
	47	3	22		9	24	22
C's	47	6	46		8	30	27
Difference	3	24	= 204,	Log = 2 3096	53	55	= 3235, Log = 3 5099
Sect. ($8^{\circ} 57'$), mean decl ,				0.0053 subt.,			2
				2 3043	10470000		Log. = 7.0198
				2 add,	40610		
40610	Log. = 4 6086			10510610			Log. = 7 0216 ÷ 2 =
True distance of A and C,			3242"				Log = 3.5108
Measured distance on Map, $\frac{1}{4}$ -inch scale,			915				Log = 2 9614
							Log ratio, 9 4506
6 " = 409	Log = 2 6117	6 " = 379	Log = 2 5786				
	9 4506		9 4506				
Log ratio,							
	115	Log = 2 0623	107	Log = 2 0292			

The distances 115 and 107, taken from the same scale, are those by which it is necessary to *lower* the places of A and C on the map, to find their relative positions unaffected by refraction. We *lower* the places here in consequence of the eye-piece being a *direct* one, if it *inverts* the objects, the true place will be *above* the apparent on the map. We can

now, by a similar process, find the difference of altitudes of the comet and any one of the stars which will give the apparent altitude of the comet = $8^{\circ} 14'$, and the refraction is then found to be $6' 24''$, which is reduced as before, by means of log ratio, to divisions on the scale, and determines how much the true place of the comet is below the apparent. The true places on the map are denoted by black round dots in a vertical line under the apparent.

The logs. of the differences of right ascension and declination found above,

are	2.3043	3.5099
Log. ratio,	9.4506	9.4506

Diffs., on scale of A & C, in $AR = 57$ Log = 1.7549 in $\delta = 915$ Log. = 2.9605

These distances are now to be made the base and perpendicular of a right-angled triangle, of which the hypotenuse is the distance of the correct places of A and C. The right angle is turned to the left of the line joining A and C, in consequence of A being W. of C, the contrary must of course take place in an inverting telescope. The base and perpendicular of the right-angled triangle are the continuous lines terminating in the true places of A and C in the figure. The correct place of the comet is now transferred to the longer of these lines, by a perpendicular, which perpendicular in our figure is the difference of the right ascensions of the comet and C, = 290 divs. on the scale; the distance of the correct place of C from the foot of the perpendicular is the difference of the declinations, = 284 divs. on scale.

Log 290 = 2.4624
Sec. ($8^{\circ} 39'$) mean decl., 0.0050 add.

Log. 284 = 2.4533

Log. ratio, $\frac{2.4674}{9.4506}$

9.4506 subtr.

Comet, ($1040''$ Log 3.0168
C's $AR = 47^{\circ} 6' 46''$ E. of C.

($1007''$ Log. 3.0027
 $\delta = 16^{\circ} 47' 27''$ S. of C.

Comets, $AR = 47^{\circ} 24' 6''$

$\delta = 8^{\circ} 47' 14''$

My portable universal instrument, by Birtel, used as a Transit, together with an excellent Siderial Chronometer, by Sharp, of Dublin, enabled me to be quite accurate as to time. From three places found in this way an approximate orbit of the great comet of 1843 was obtained viz:—From obs. made at Nice on 17th and 24th March, and 2nd April.

P P. February 27. 0445

L. P. ,, 265 17 33

L. N. ,, 355 20 28

I. ,, 37 4 19

Log. P. D. 8.59216

Motion—Retrograde.

This orbit is, of course, only a very rough approximation to the true but by comparison with those presumed to be most accurate, it will be found to be sufficiently good for purposes of identification.

E. J. C.